MODERN PLASTICS

MARCH 1946

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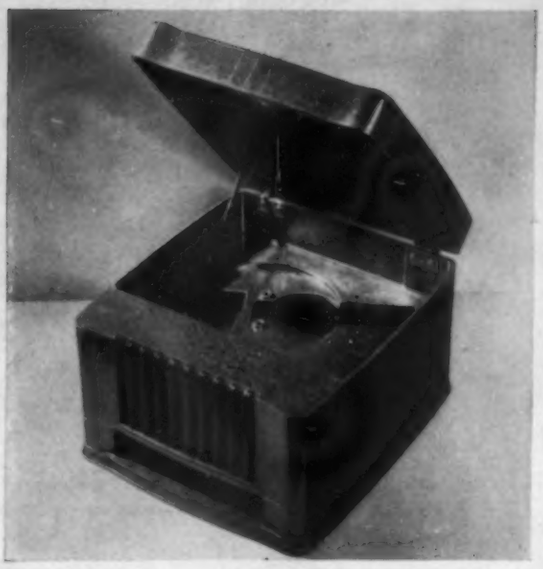

INTERESTED IN LARGE PLASTIC PIECES?

Dispelling the time-worn theory that large molded plastic pieces are impractical and uneconomical, these Admiral phonograph and radio-phonograph cabinets effectively demonstrate that large products as well as small can be molded of Durez phenolic plastics.

The bigger cabinet (right) when assembled contains a five-tube radio and automatic record player. The molded Durez body weighs 9½ pounds and the cover 3½ pounds. This makes a total cabinet weight of only 13 pounds.

Radio Frequency Preheat

Compression-molded in a 400-ton press, the special Durez compound used in this larger unit is preheated by radio frequency. This modern method of production facilitates the molding operation considerably and results in the strong, attractive cabinet shown.

The smaller unit, Admiral's automatic record player, is also molded of Durez but in a 300-ton press.

Why Plastics?

The progressive Admiral Corporation experimented and found that for top quality cabinets of this type—having light weight and an integral, lustrous finish, plastics were better suited than any other material.

Why Phenolic Plastics?

The excellent moldability, impact strength, eye-appealing finish, and the non-resonance of phenolic plastics proved the decisive factors in the choice of these most-versatile-of-all-plastics.

Why Durez Phenolic Plastics?

As specialists in the production of phenolic plastics for the past quarter century, the Durez staff have developed more than 300 multi-propertied Durez phenolic molding compounds from which to select the plastic that precisely fits the job.

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"Machining Data on Phenolic Plastics" is an informative manual which covers all the standard machining operations encountered in the average plant. Write for your free copy. No obligation, of course. Durez Plastics & Chemicals, Inc., 53 Walck Road, North Tonawanda, New York. *Export Agents: Omni Products Corporation 40 East 34th Street, New York 16, N. Y.*

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Catalin casting techniques are now so highly advanced as to encourage product developers to plan freely in all three dimensions – and without having to face expensive custom mold costs. In many instances, the use of standard Catalin shapes admirably serve the specifications. The members of our experienced service staff will gladly welcome an opportunity to lend a hand to those who are planning to manufacture products of plastics. Inquiries invited!

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AND PLASTICS

VOLUME 23 MARCH 1946 NUMBER 6

General Section

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This editorial marks a departure from Modern Plastics' practice of maintaining a strictly impartial attitude on issues affecting the industry. However, the times seem to call for direct and decided action—a call we are answering by instituting a regular editorial page which will appear in the same position, on page 7, in each issue.

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* Reg. U. S. Patent Office.

We'll hang our story on a clothesline

Desirable properties suggest uses for **GEON** *raw materials in every industry*

★

THAT clothesline in the picture is something new. It consists of a flexible rope or metal core, covered with one of the GEON polyvinyl materials. It has certain definite advantages over conventional clotheslines—all of which can be translated into improved finished products in literally every industry and in the home.

For example, the clothesline is practically age-proof—resists the effects of sun, rain, light, heat, cold. It won't crack or get gummy even after prolonged exposure to weather. It's easily cleaned with a damp cloth—no dirt or grime can penetrate it. It's mildew-proof—fungi can't enter the surface. It will wear indefinitely—pull it around hooks thousands of times—no snagging, no breaking of the tough coating. It's smooth, flexible, easy to handle. It's brightly colored for high visibility and attractive appearance.

Consider those properties—plus others such as excellent electrical properties and resistance to acids, oils, and chemicals—in light of the fact that GEON can be extruded, pressure or injection molded, used as coatings for fabric or paper, calendered or cast into sheet or film. *The number of established and potential applications in every field is literally limitless.* For more information about GEON polyvinyl raw materials or for help with specific applications, please write Dept. I-3, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, O.

Here are a few applications for GEON suggested by the clothesline

Textile coatings for rainwear, awnings, industrial aprons.

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Calendered or molded sheet for flooring, shoe soles, shower mats.

Paper coatings or film for packaging, wall covering.

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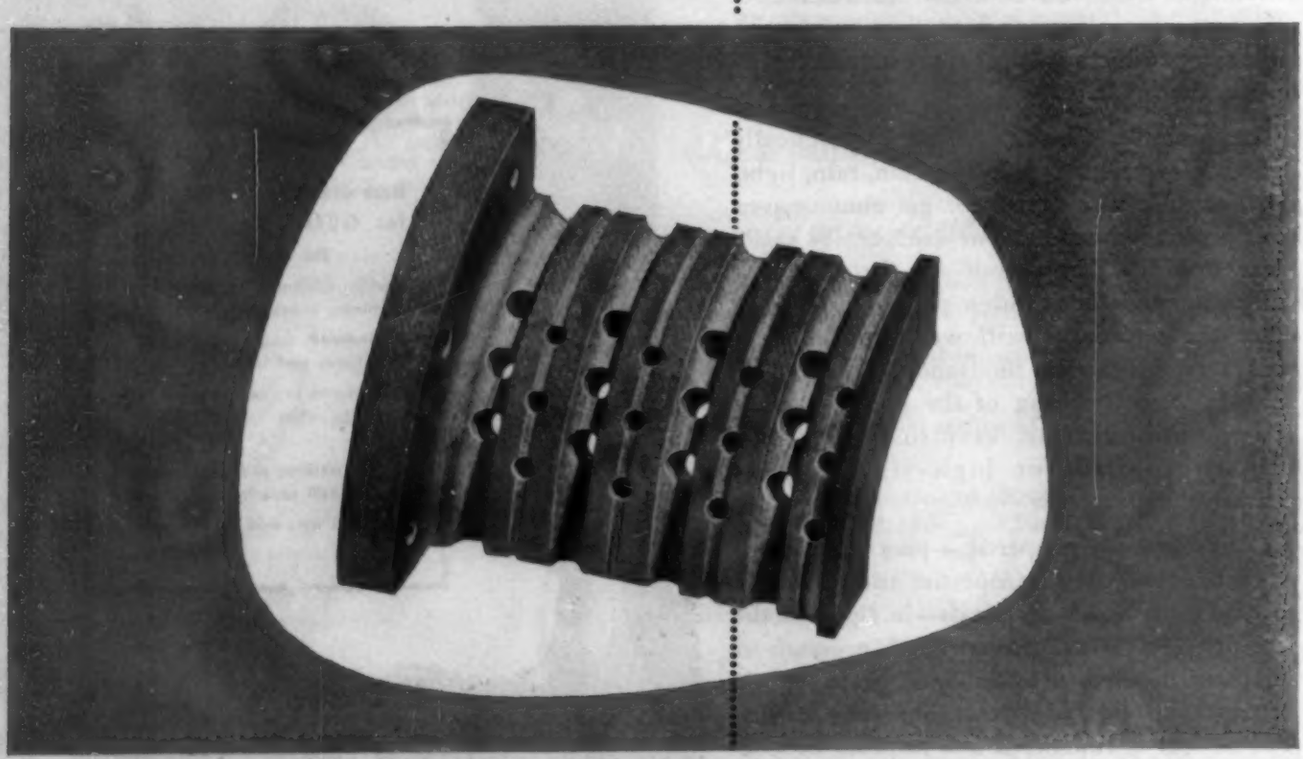

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Truth is so easily distorted

Plastics is a sure-fire catch word to newspaper editors and reporters. From a public relations standpoint, there are many advantages in having the world beat a path to your door. But penalties are also involved, for merciless inquisition always follows public curiosity about a subject. No matter whether it is man or matter, the subject's so-called weakness or possible frailties are sought for and publicized. These broadcasts may be half-truths, total untruths, misunderstandings or misquotations, silly chatter or pure gossip but those who repeat them aren't often too particular if they can get attention.

One of these literary stink bombs was dropped in the laps of the plastics industry a few months ago when reporters in a New Hampshire city gleefully licked their chops over a report that heated melamine would give off cyanide gas in dangerous quantities. Even Roger Babson pontificated upon the dangers of melamine in his stock reports and suggested national legislation to control its use.

Sure, heated melamine gives off cyanide gas—so does wool, felt, leather, beefsteak and many other nitrogenous household items. It is frequently in the air around us, but not in sufficient quantity to be harmful.

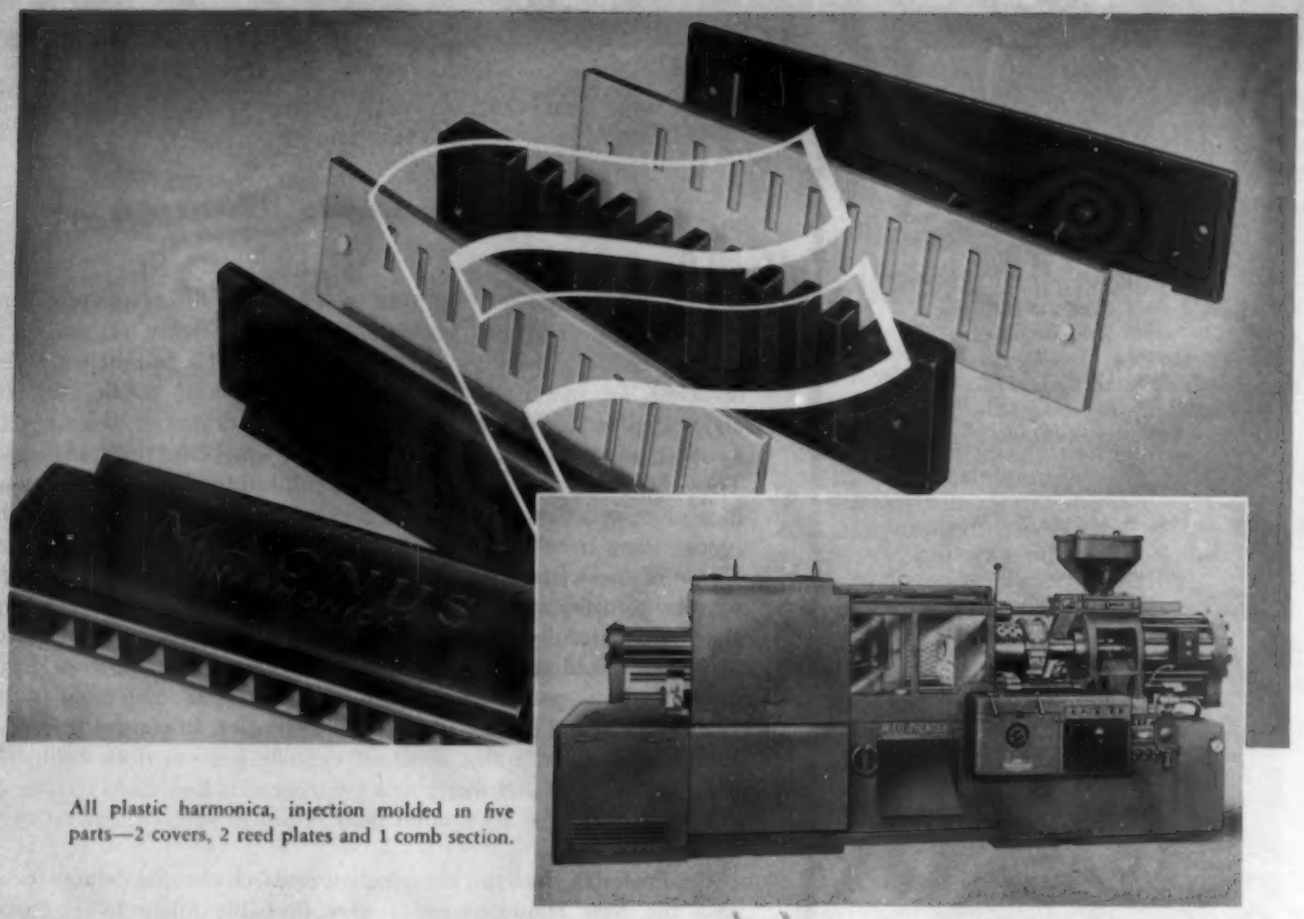
Dr. Foster D. Snell, an independent research chemist demonstrated that the New Hampshire rats were probably killed by the same processes that overcomes man or animal when smothered to death in a fire. The story concerning this business of knocking out the cyanide ghost is on page 103 of this issue.

The cyanide story is only one of these inquisitorial chapters which the industry must endure. Another was instigated by a funny-man who makes millions of people laugh in a daily syndicated column. Much to his amazement he discovered that plastics would melt. He didn't pin it down to any type—it was just plastics. He raved particularly about the embarassment of the poor lady who would be left garbed only in her earrings when her plastics gown melted after contact with the fireplace.

He didn't mention what would happen to a lady's taffeta or cotton or linen gown if it caught fire from the fireplace nor why any lady would caress a fire with her dress. Too bad he didn't know about the once popular nitrate collar which men wore for years, though no one ever heard of a gentlemen singeing his whiskers by sticking his neck into a fire just to see if his collar would burn.

Oh sure, sure! The funny-man was just having a bit of fun and no one should take it seriously, but when queried about his story, the man evidently took himself seriously and insisted that plastics would melt. Nuts, we say. Wood burns—cotton rots—linen yellows—iron rusts—glass breaks—dogs fight and cats howl.

And may we suggest that if the circus tent which burned two years ago had been coated with a certain plastic, it wouldn't have burned. The Navy used literally tons of certain plastic materials because they were fire resistant. And we'll wager that if that same funny-man buys one of the new Palm Beach suits which is wrinkle- and shrink-proofed by plastic resins, he won't throw it in a bonfire to see whether or not it burns or melts.



All plastic harmonica, injection molded in five parts—2 covers, 2 reed plates and 1 comb section.

In Tune with the Times...

The new all plastic Magnus Harmonica, molded in attractive colors from polystyrene by the International Plastic Harmonica Corp., Newark, N. J., on the Reed-Prentice 10D-8 Oz. injection machine (shown above)—is non-fragile, hygienic and economical to make.

These parts are produced from a 4 cavity mold and require no finishing operation for assembly other than removal of the sprue.

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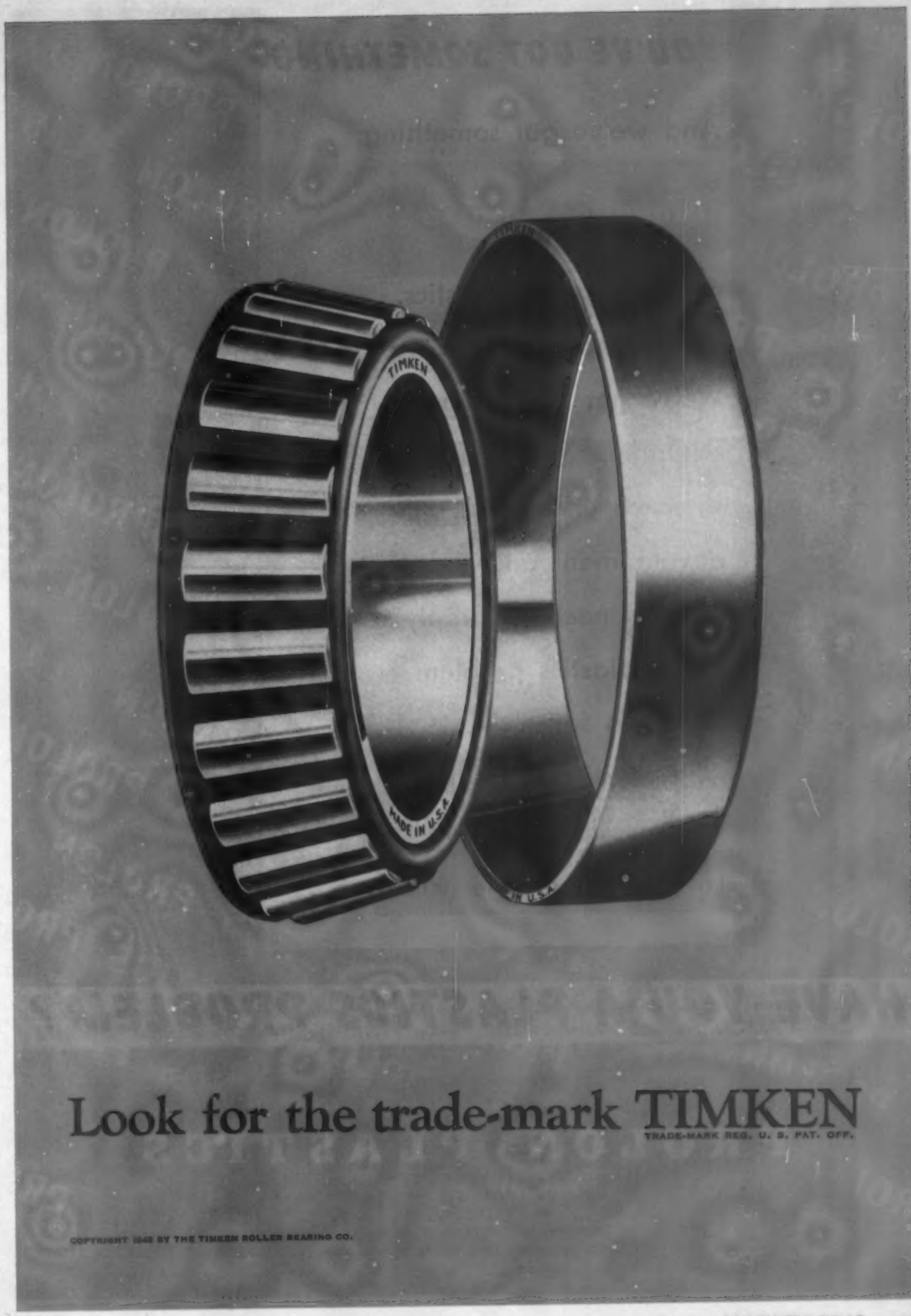

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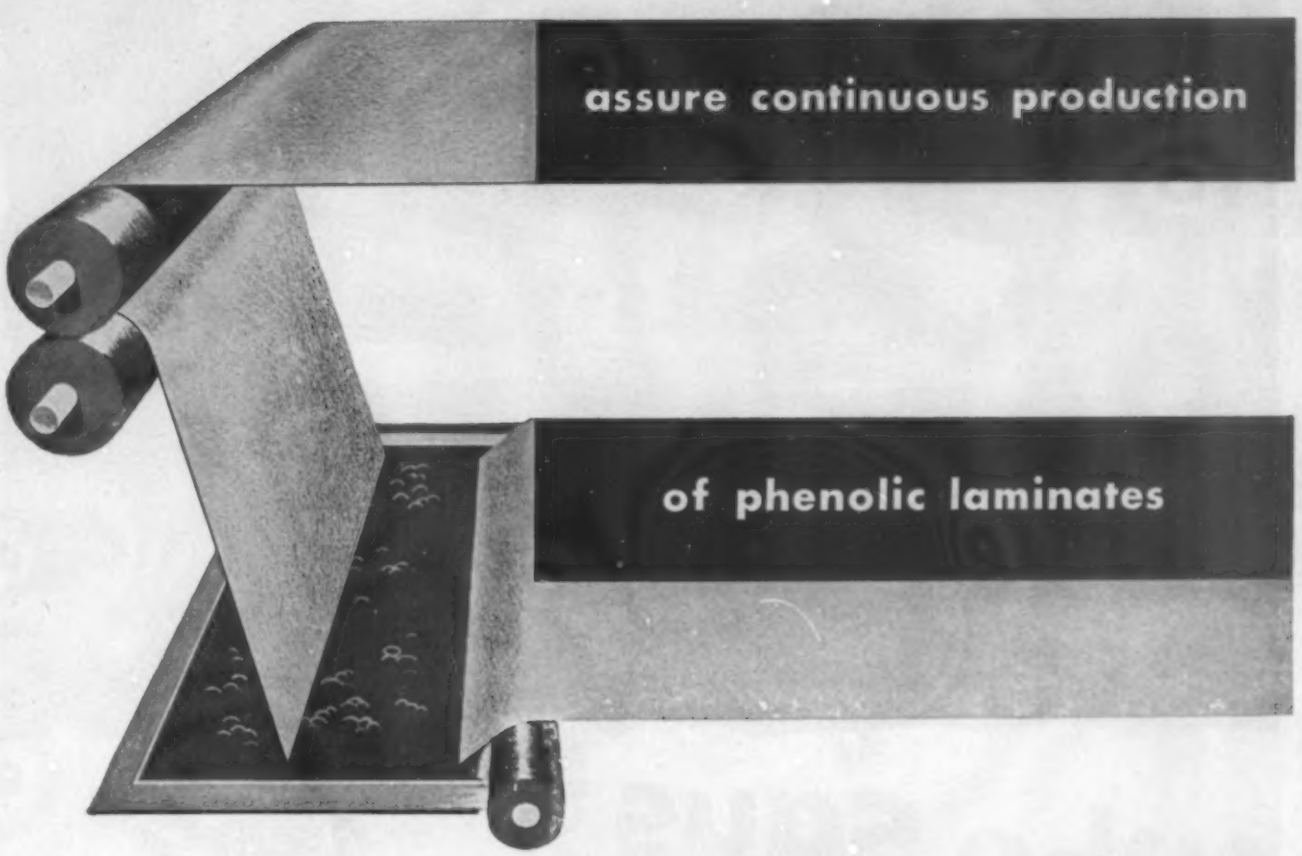

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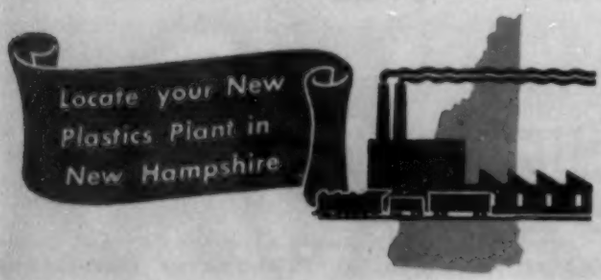

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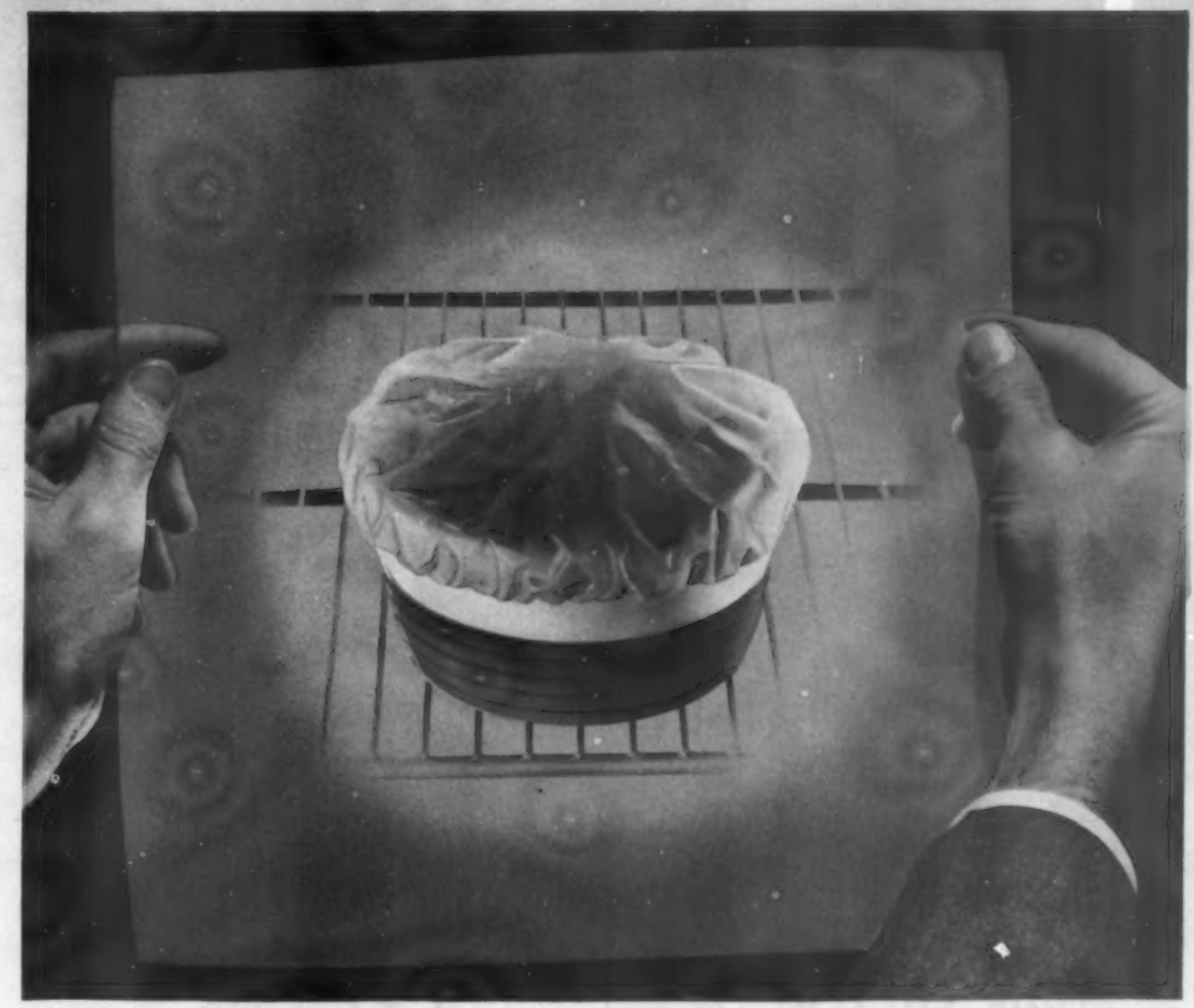

HE LOOKED AT A POLYTHENE SHEET

...and saw a better way to save food

WHAT'S NEW. Smart raincoats and hoods of Du Pont polythene take full advantage of polythene's light weight and toughness. Among some 40 other articles being manufactured from polythene sheeting by Boland Mfg. Co., Chicago, Ill., are shower curtains, garment bags, food covers.

A year ago he was just a man with an idea. To make it a marketable product, he needed a material strong, tough, resilient and waterproof...found it in Du Pont polythene. Today his bowl covers are in many a refrigerator.

One more new and better product... thanks to one man's knowledge of the properties of a Du Pont plastic.

Bowl covers, of course, are just one recent example. Another new product shown at left adds one more to the growing list of brain-children given reality by this versatile Du Pont plastic.

Have *you* an up-to-date picture of today's Du Pont plastics? There have been recent new developments. Write E. I. du Pont de Nemours & Co. (Inc.), Plastics Dept., Room 363, Arlington, N.J.

Refrigerator bowl covers, in assorted sizes, are made by Seal Sac, Inc., New York, N. Y. and Boland Mfg. Co., Chicago, Ill. Polythene sheeting extruded by Visking Corp. Chicago, Ill. and The Plax Corp., Hartford, Conn.

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Plastics

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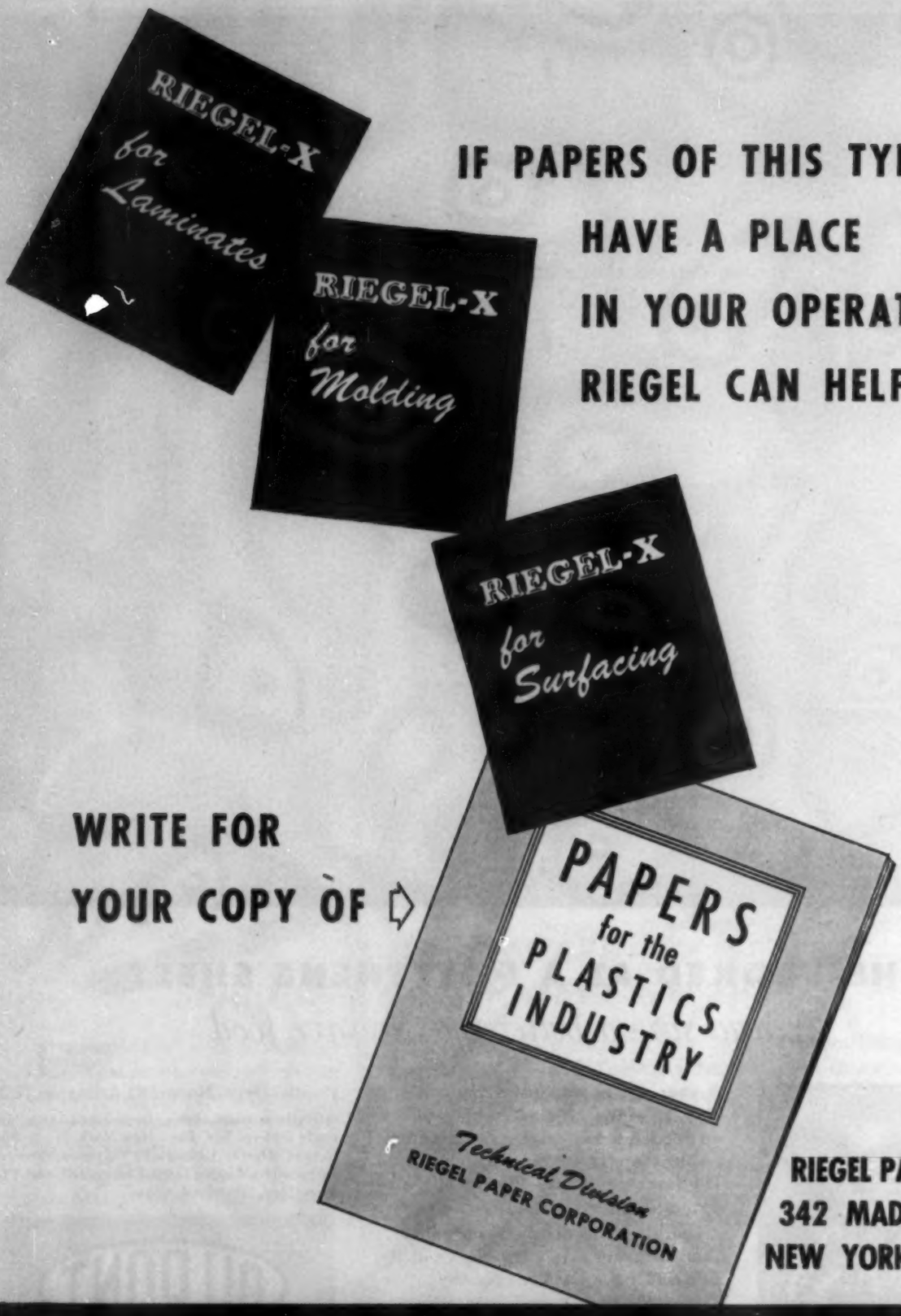

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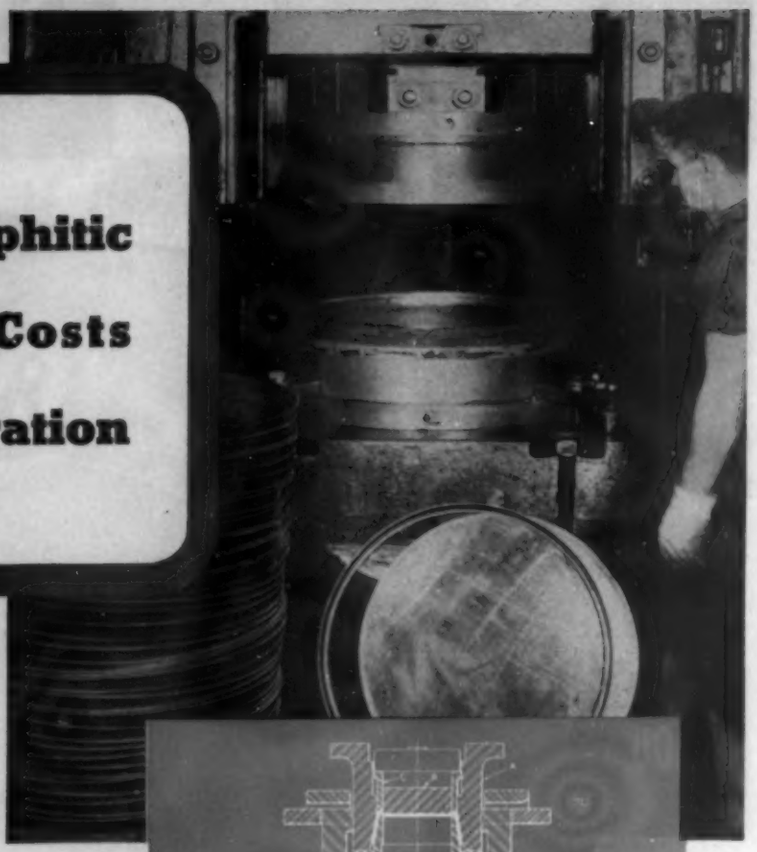

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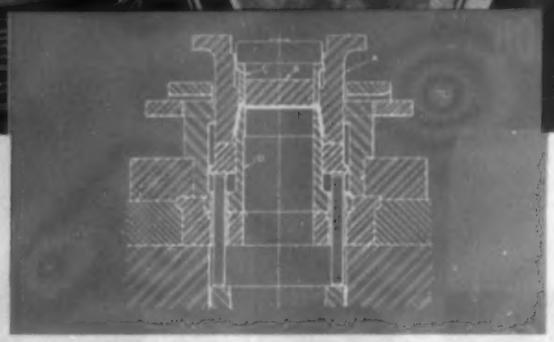

Blanks pictured here are 28.750 inches in diameter and require a draw 1½ inches deep. Bottom of cage is 24½ inches in diameter and is punched out without any shear on punch or die. The slug comes out flat and can be used for another caged blank of smaller diameter.

Use of Graph-Mo Steel, one of the 5 Timken Graphitic Steels, in 6 vital parts of this die has brought a saving of *25% in cost!*

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If you don't have a copy of our 48-page book — "Timken Graphitic Steels", write for a copy today. Steel and Tube Division, The Timken Roller Bearing Company, Canton 6, Ohio.

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ELECTROMAGNETIC

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How successful this process was is indicated in the Smyth Report.

We quote:

"Construction of the first series of electromagnetic units at Clinton began in March of 1943 and this part of the plant was ready for operation in November 1943."

8 MONTHS TO FIRST OPERATION

"For nearly a year the electromagnetic plant was the only one in operation."

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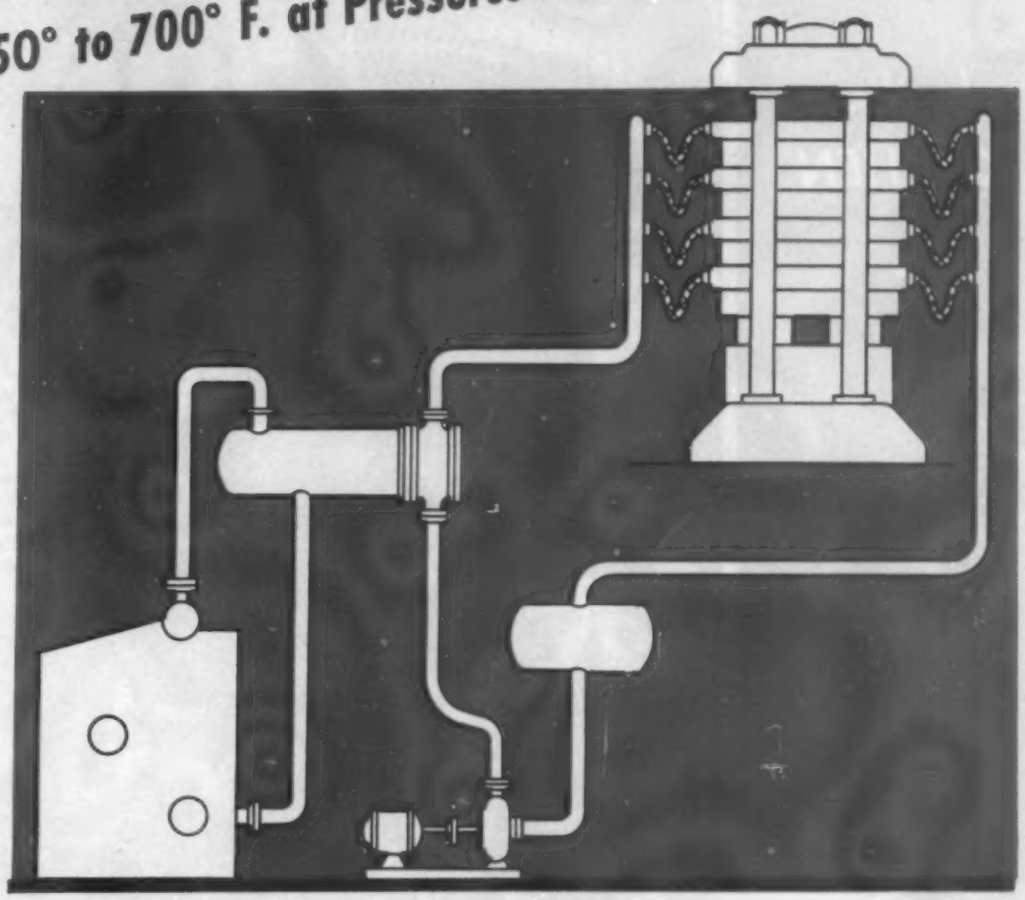
350° to 700° F. at Pressures below 125 PSI



UNIFORM HEATING THROUGHOUT the PLATEN SURFACE

The rapid advance in moulding processes and the desirability of employing plastics requiring higher manufacturing temperatures throws the spotlight on Dowtherm systems for heating the platens of moulding presses.

Higher temperature with precision control not only increases production with such moulding material but also improves the quality of the product.

One of the great advantages of Dowtherm heating is the positive assurance of equal heating throughout the moulding surface.

The range of temperatures is wide but at 700 deg. F. the pressure is only 100 lb. per square inch. The Dowtherm system is essentially simple and for processing industries gives advantages over high pressure steam systems and electric heating.

Various temperatures may be maintained in different presses or in different parts of the process, if so desired.

Bulletin ID-43-5 on Dowtherm heating is available upon application. Requests for information on moulding processes will receive special attention.

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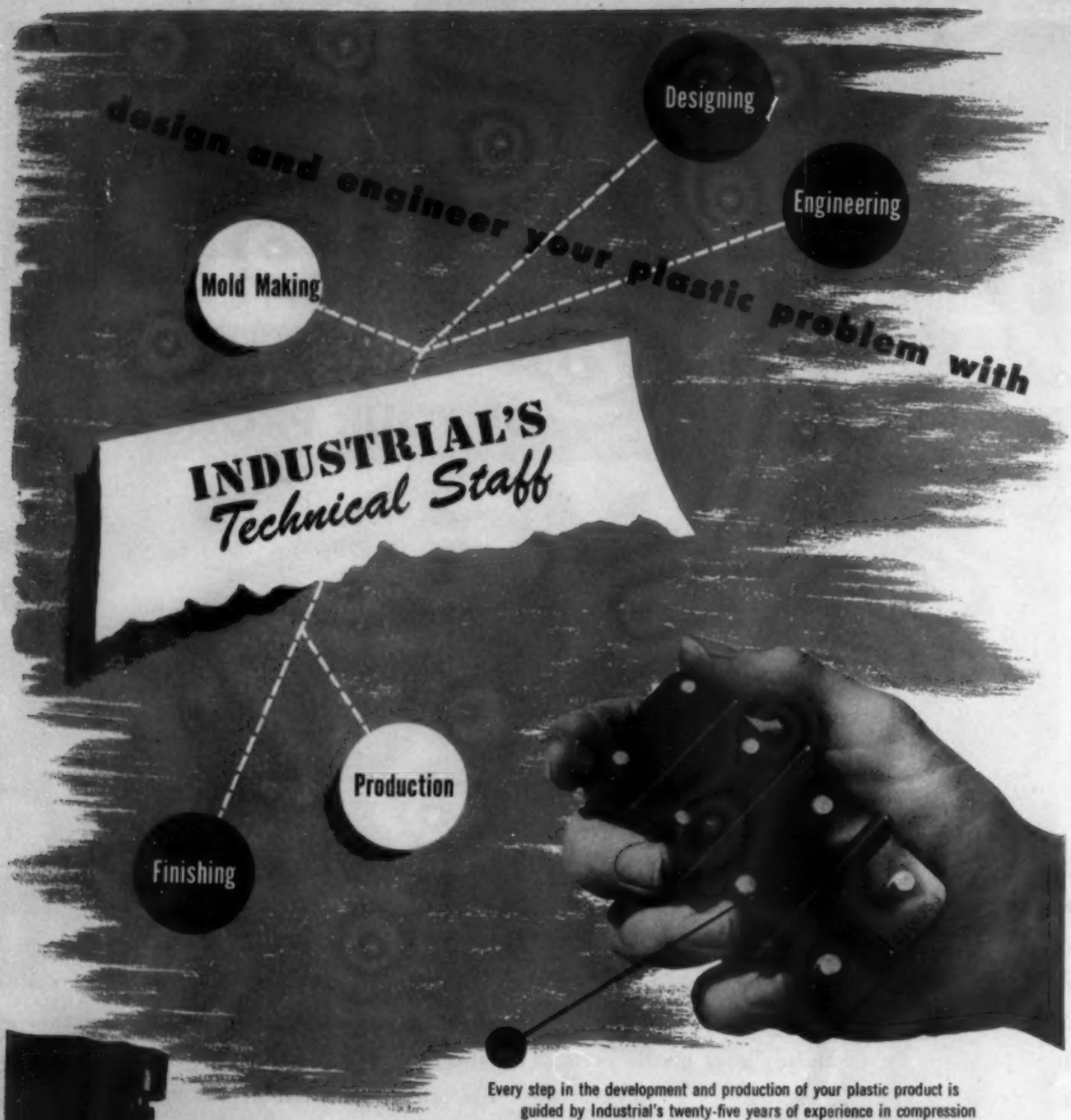

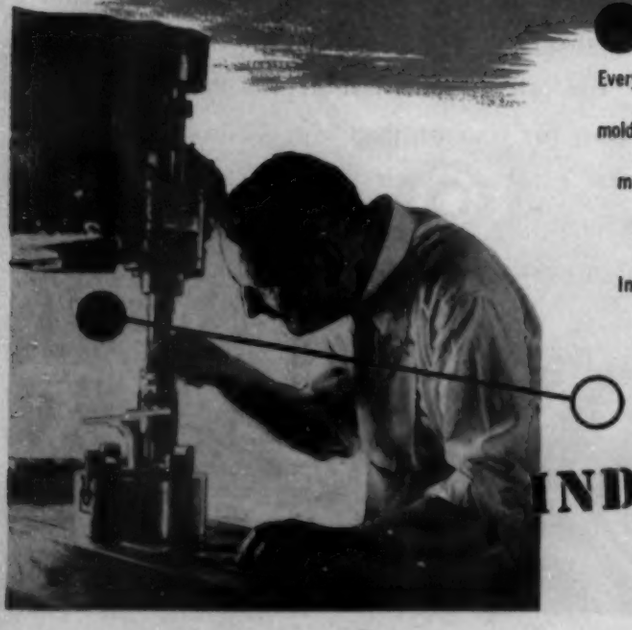

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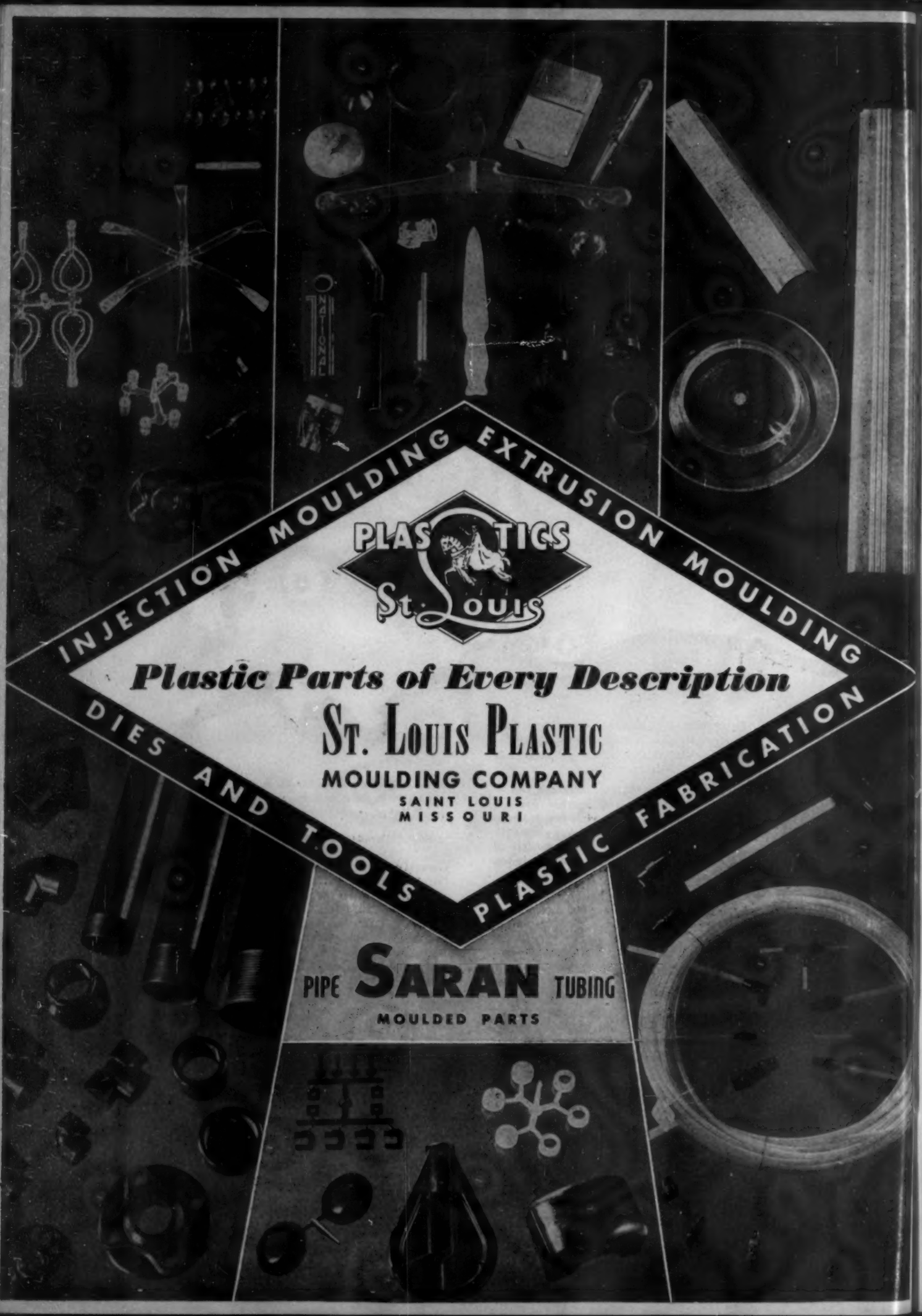
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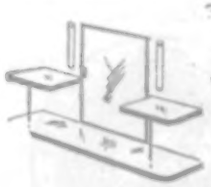

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CP-44

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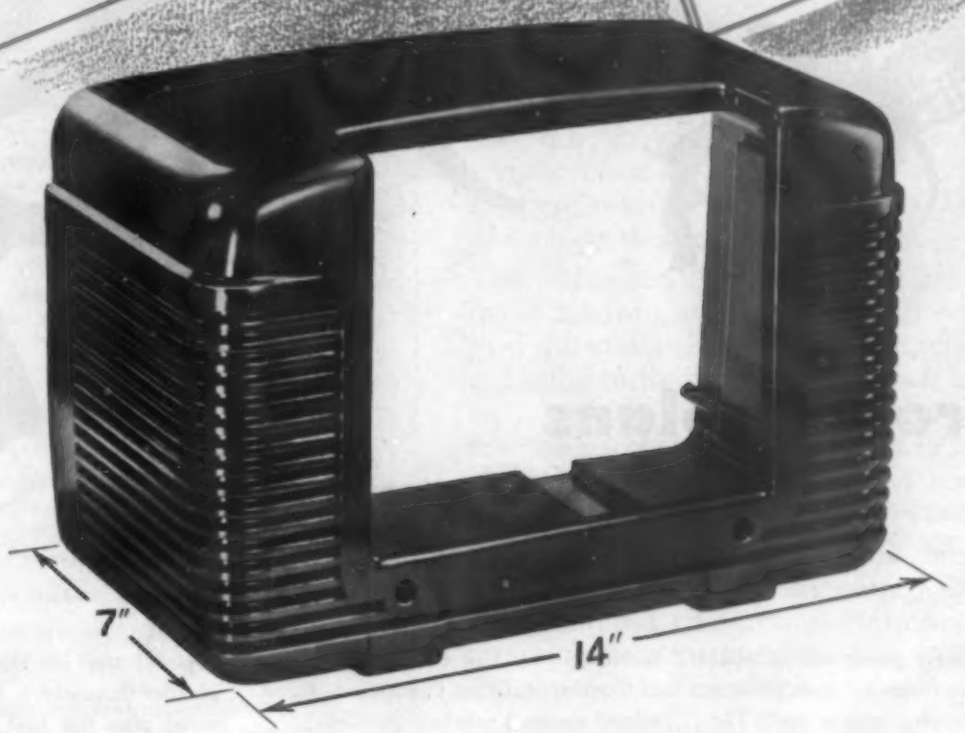

By incorporating Radio Frequency heating and Automatic Controls, large daily volumes are being realized on the illustrated 3¾ pound plastic cabinet being molded for the Crosley Corporation's new postwar line. Quality, delivery and uniformity are assured in this new, large molded cabinet.

INTERNATIONAL's facilities are at your service with meticulous supervision of details that will please you. For complete engineering and molding service we invite your inquiries.

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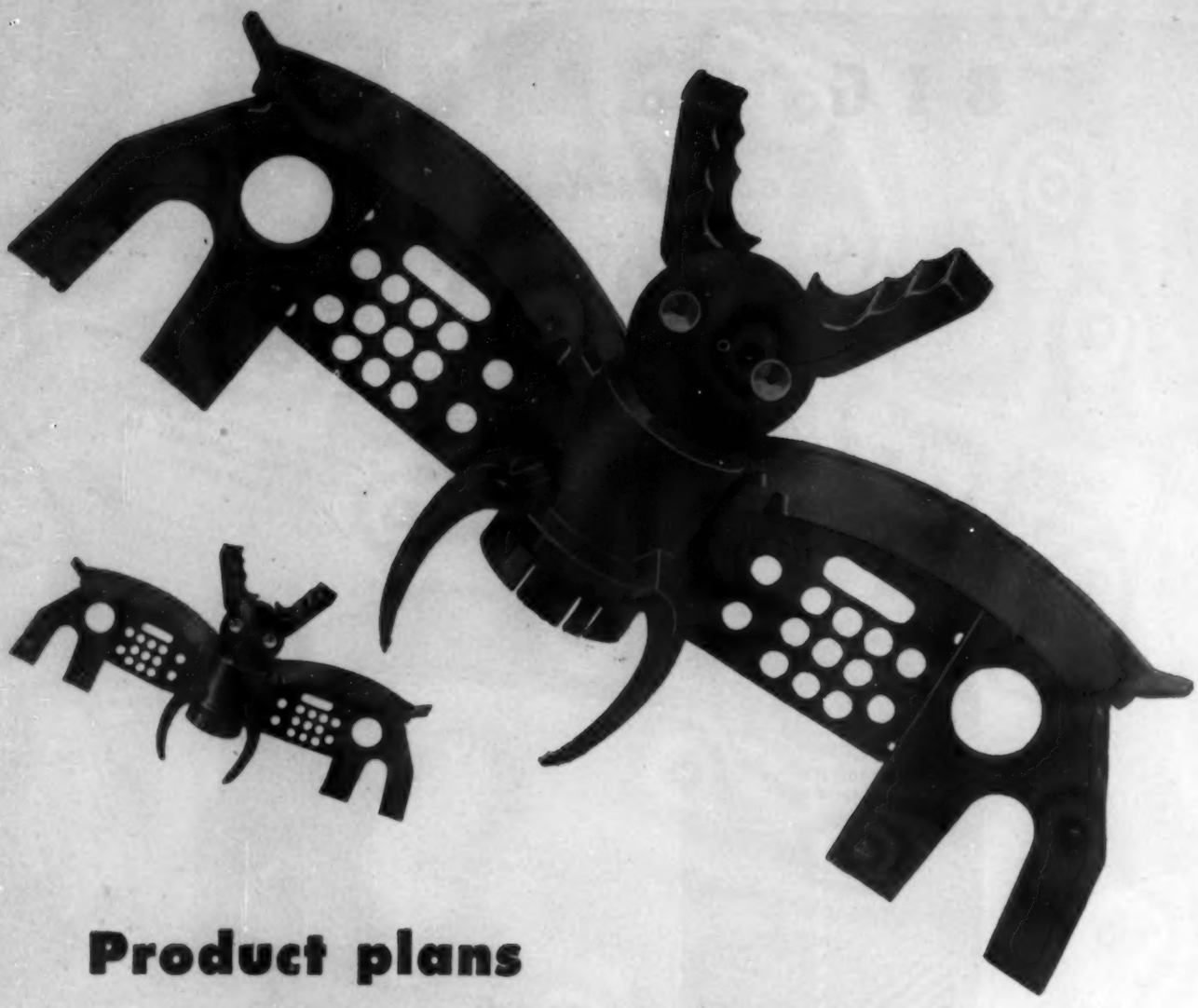

Product plans driving you "bats"?

Are you quietly going out of your mind trying to improve your present product or develop a new one? The bats above may suggest your answer. They're made entirely of plastic parts. The face is a plastic distributor part. The feet are coffee pot handles—of plastic. And so on. And plastics—as fabricated by the Plastics Division of Continental Can Company—have solved many a product problem.

If it's humanly possible to plan *your* product with plastics, you can depend on Continental's staff of skilled engineers and research men. You can depend, too, on the quality of the plastics themselves. The best of equipment plus the best of "know how" combine to give you the best of service.

Plastics are no cure-all. But they do possess certain qualities of beauty, durability, lightness, and economy that give a product much-needed eye- and buy-appeal. Drop us a line and let us know your needs. We'd be glad to tell you if plastics are the answer to *your* special problem.

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can be FABRICATED to your order

PROPERTIES

PANELYTE properties are listed below—not as descriptive of any one grade of these paper, fabric, fibre glass, and asbestos base thermo-setting plastics—but to show the range of properties of the 32 grades.

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Volts/Mil. Short Time Test, ¼" Thickness—up to 700 volts.
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Izod Impact Strength (ft. lbs. per inch of notch)—0.5 to 20.
Compressive Strength (psi)—20,000 to 55,000.
Tensile Strength (psi)—7,000 to 35,000.
Modulus of elasticity in tension (psi x 10^5)—7 to 30.
Flexural Strength (psi)—12,000 to 40,000.

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20 Cubic Inches Per Pound—Half Weight of Aluminum.

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As low as 0.7% in 24 hrs. immersion.

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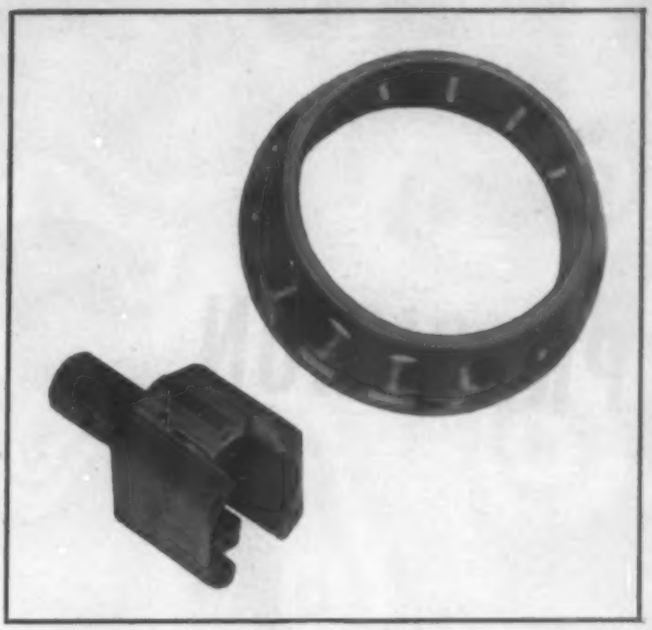

Two examples of Panelyte *precision* fabrication are shown above. Panelyte laminated plastic, Grade 942, was selected for the ball-bearing retainer ring, 2 15/16" O.D., because of its high dimensional stability.

The enlarged Panelyte Fabricating Plant (most modern in the industry) is equipped to turn out similarly accurately machined parts . . . lathe-turned, drilled, reamed, and undercut . . . for you. Or intricate radio parts such as the one shown of Panelyte Grade 550, requiring three turret lathe operations in addition to milling, drilling and tapping.

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PANELYTE *the structural plastic*

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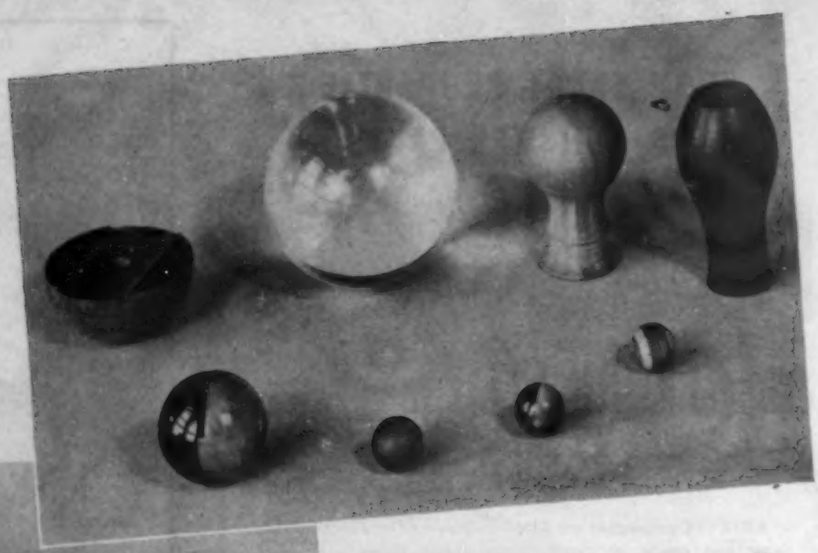

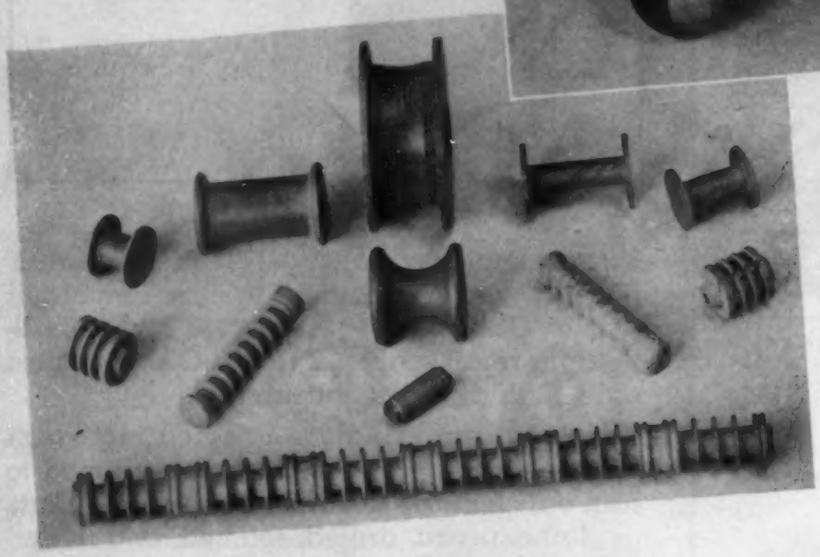

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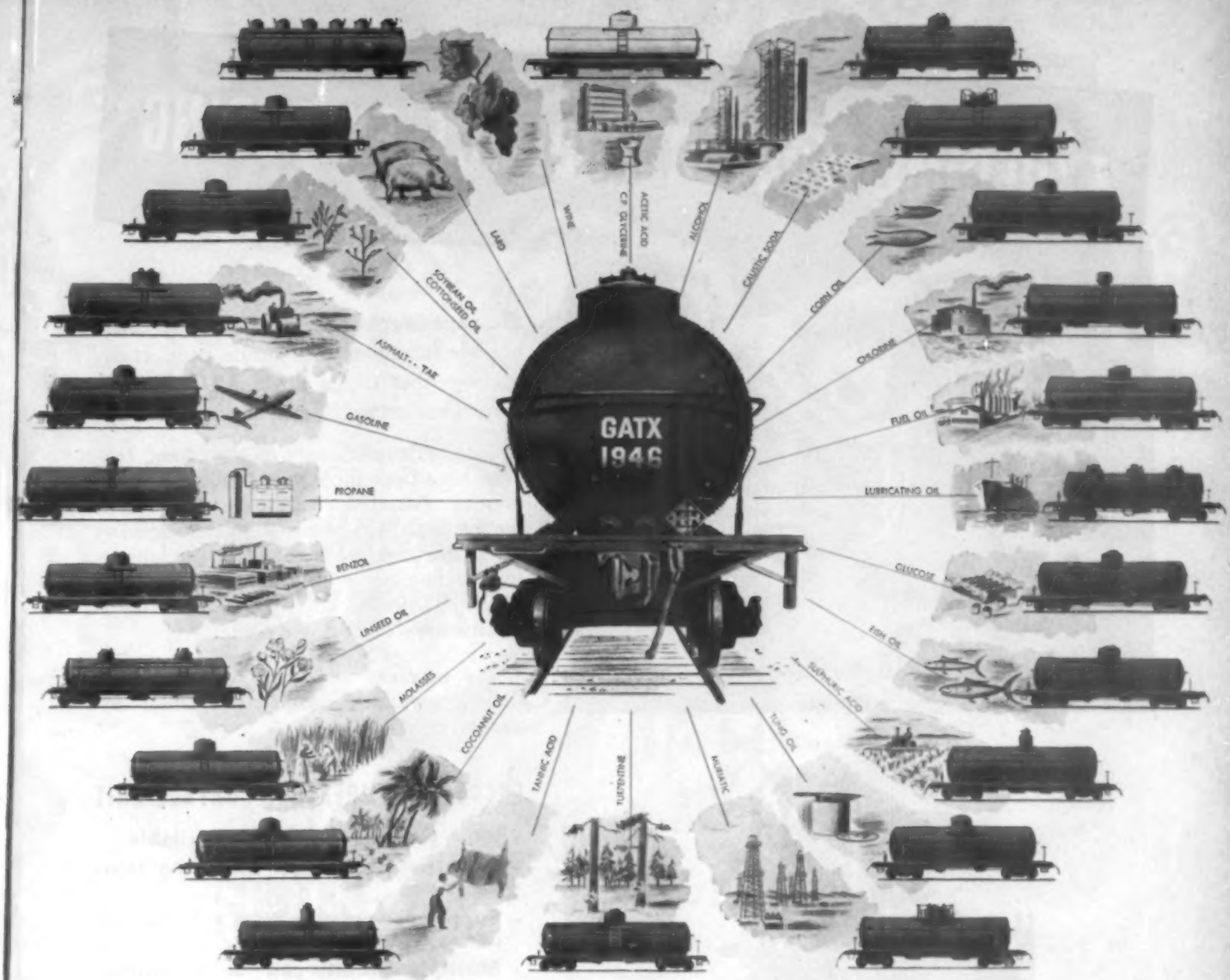

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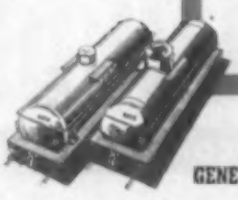

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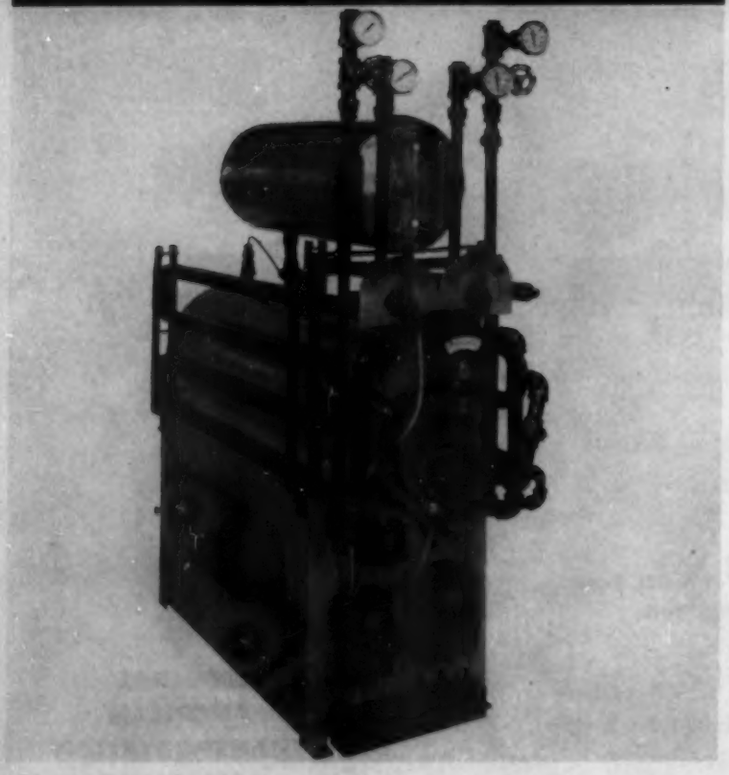
EXPERIMENTAL OR PRODUCT EXTRUDING



An experimental extruding machine capable of efficient and economical product extruding—that is the Royle #1 (2" bore) continuous extruding machine.

Through evolutionary development, features have been incorporated in Royle continuous extruding machines which will secure successful results with the growing list of extrudable compounds. The laboratory technician is assured that the results obtained with his Royle #1 will be reproduced with larger Royle models.

The inherent efficiency of Royle continuous extruding machines is further enhanced by the

EXTRUDER TEMPEATURE CONTROL UNIT

- **Wide temperature range available**
- **Sustains high or low extruding temperatures**
- **Supplies or removes heat from extruder as required**
- **Multiple circuits can be accommodated**
- **Hand lever selection of pre-determined extruding temperatures**
- **Available in two sizes**
- **Compact**

Whether you plan experimental or product extruding send for bulletins #443 and #444 and let them suggest to you how Royle extruding machines and the Royle Extruder Temperature Control Unit can meet your specific problem.

JOHN ROYLE & SONS

ROYLE PATERSON N. J.

PIONEERED THE CONTINUOUS EXTRUSION PROCESS IN 1880

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REgent 2430

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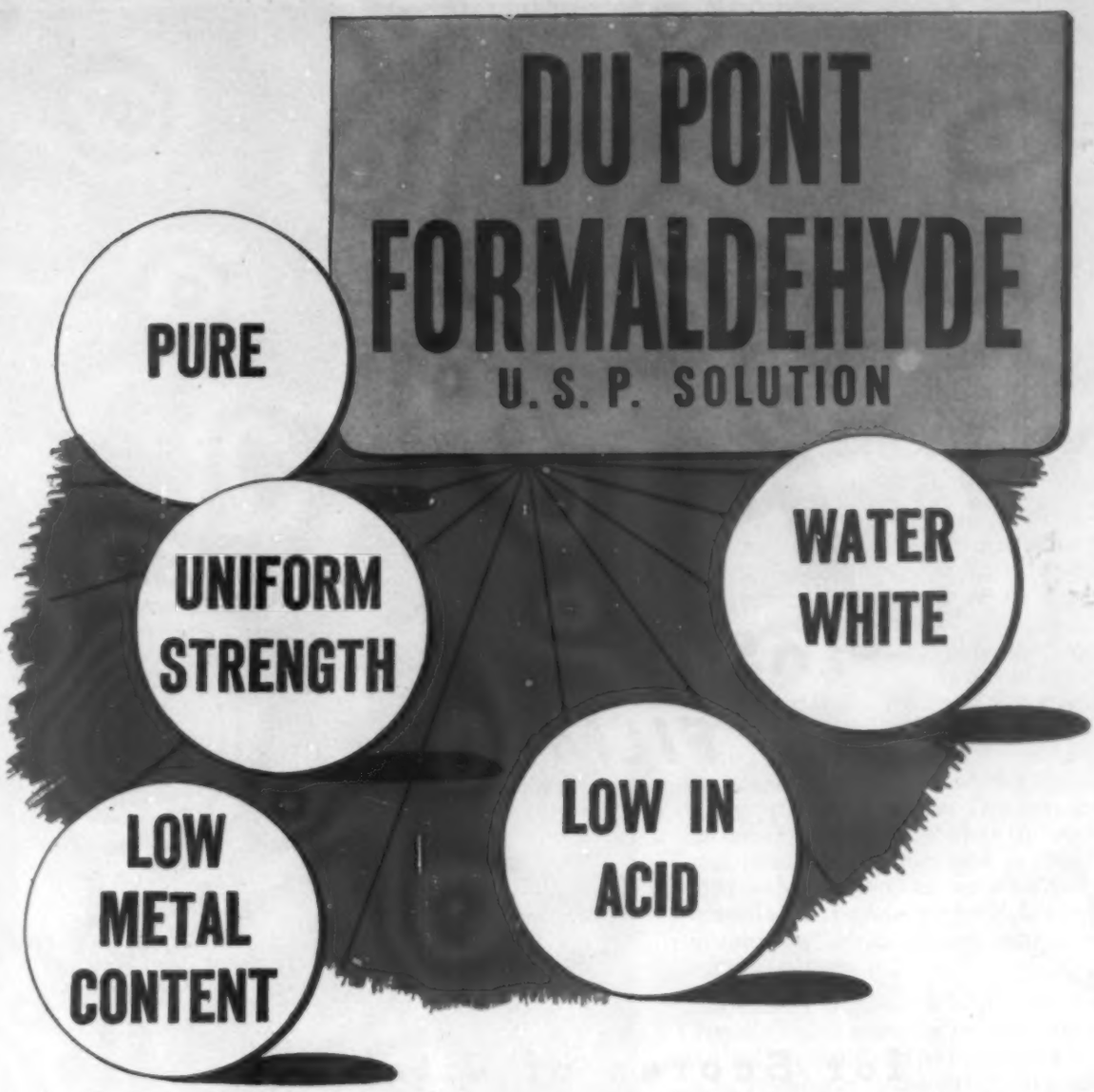
J. C. Clinefelter
UNiversity 8726

Los Angeles, Cal.
H. M. Royal, Inc.
Lafayette 2161

PATERSON 3, NEW JERSEY



DU PONT FORMALDEHYDE is designed to meet the high requirements of the plastic industry. It's completely dependable—produced under controlled conditions to assure you consistently fine raw material.

READY FOR IMMEDIATE SHIPMENT in the quantity you need. Shipments are made in standard containers from the factory or stocks maintained in principal cities.

DEPEND ON DU PONT also for your requirements of *Paraformaldehyde,* 95% minimum strength. And *Hexamethylenetetramine*—U. S. P. crystals or technical. For additional information and technical assistance, call our nearest office. Electrochemicals Department, E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Delaware.

District and Sales offices: Baltimore, Boston, Charlotte, Chicago, Cleveland, Cincinnati, Dallas,* Detroit, El Monte (Cal.), Houston,* Kansas City,* New York, New Orleans,* Oklahoma City,* Philadelphia, Pittsburgh, San Francisco, Tulsa,* Wichita.*

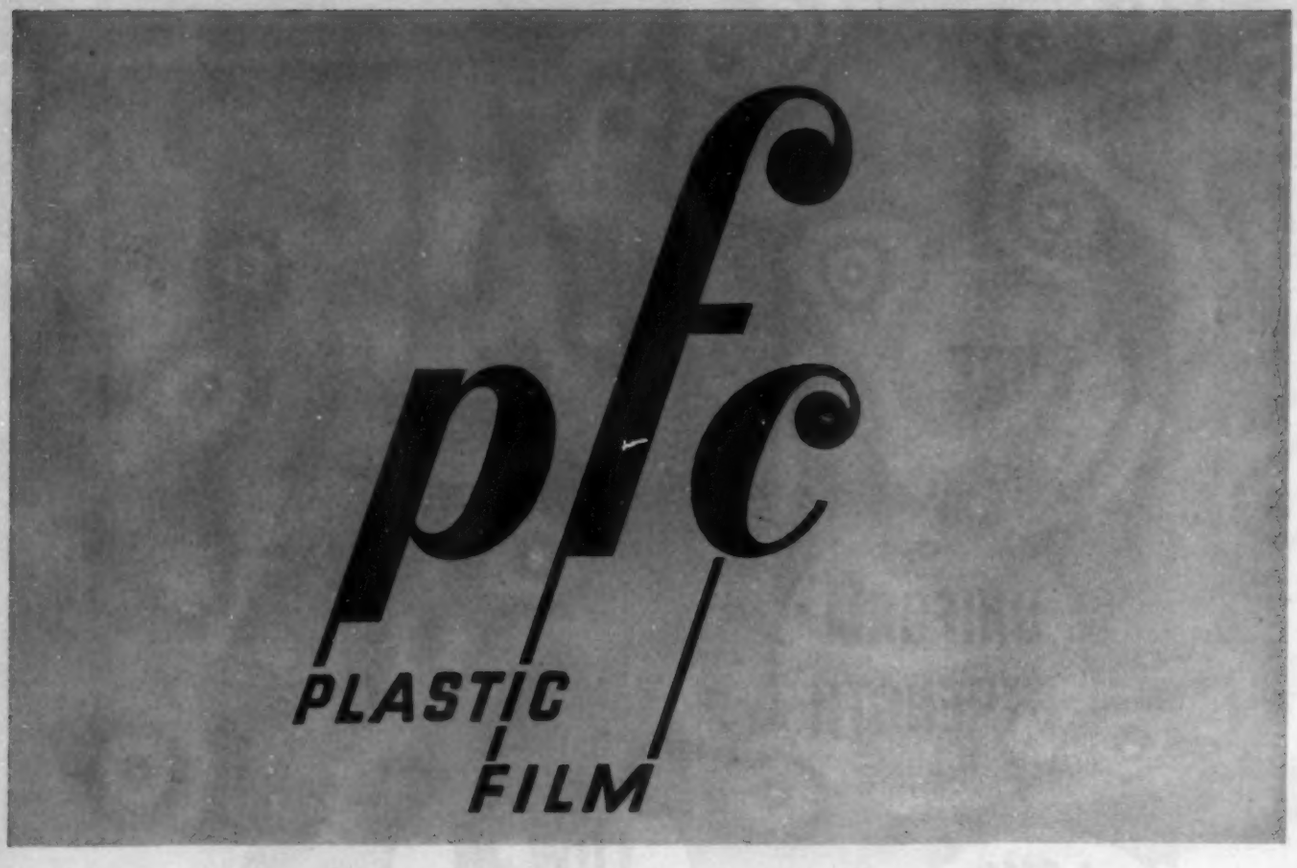
**Barada & Page, Inc.*

DU PONT ELECTROCHEMICALS

DU PONT

REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY



for Scores of Vital Jobs

PLASTIC FILM CORPORATION

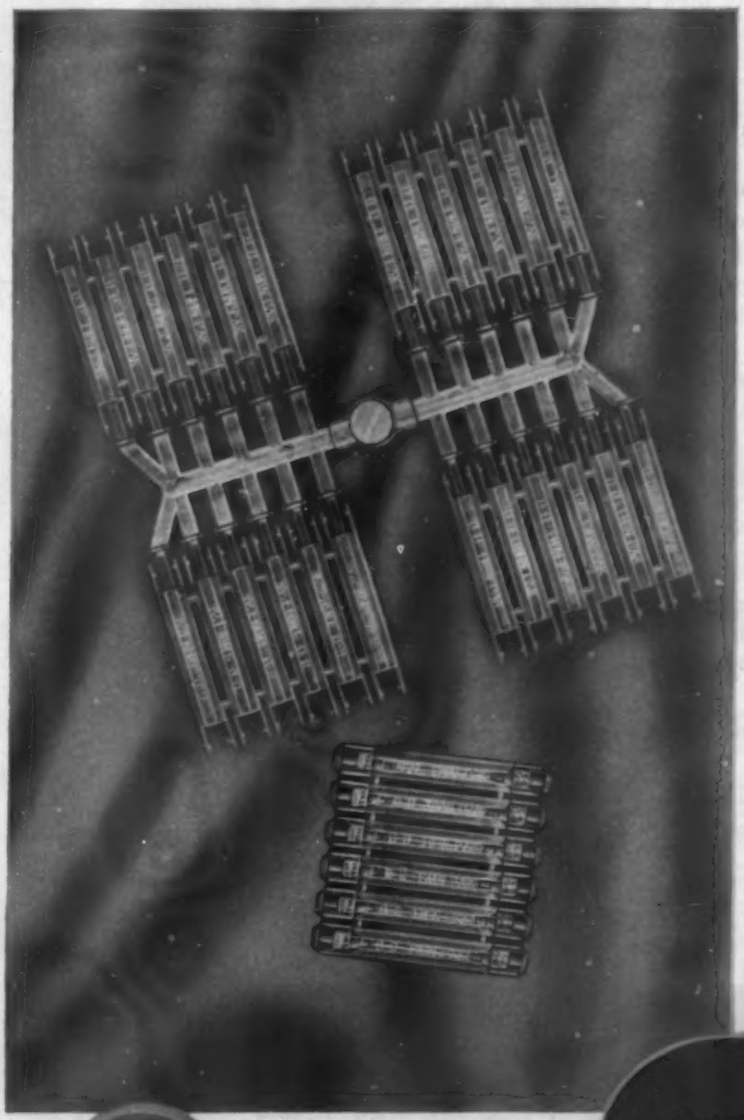
NEW YORK OFFICE: 475 FIFTH AVE., NEW YORK 17, N. Y.

PLANT AT: PLAINFIELD, CONNECTICUT

This Custom molded Package

BY ERIE RESISTOR

Offers display without exposure, inspection without handling, protection in use



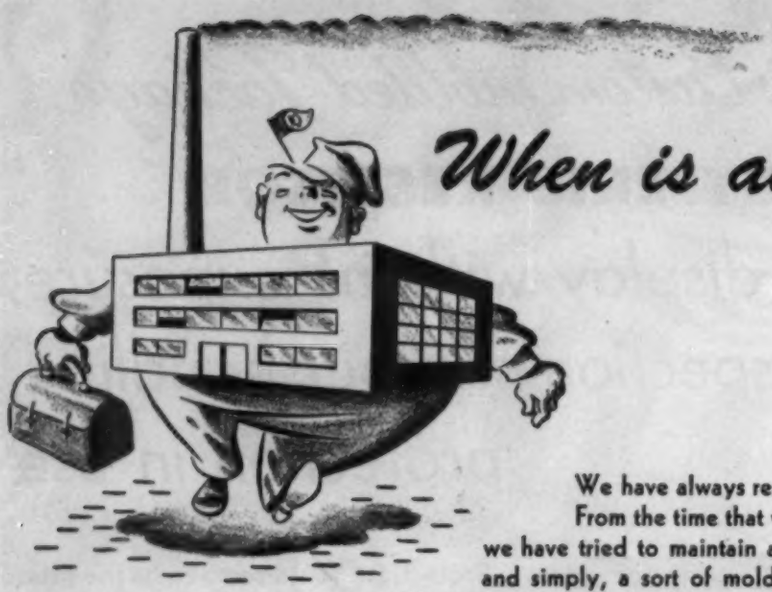
Hypodermic needle case
Courtesy Becton, Dickinson & Co.

Protection would seem to be the prime objective of any packaging design for an instrument as delicate as a hypodermic needle. Yet, even in the sale of so delicate an item, display may have an important part if, as in this instance, the display carries with it a demonstration of the practical merits of the container. The protection given to the needles on display is evidence of the protection they will have in use. The fact that the doctor can see what he is getting without handling in the store, is proof without sales talk that he can pick the needle he needs without handling or fumbling, when emergency calls for quick action.

Ingenuity of design had to be backed by skillful ingenuity in die design and injection molding to bring this triumph in packaging to the druggist's counter. Yet Erie Resistor, with custom molded plastics, made the design practical by converting what was considered a difficult and expensive hand operation into automatic and economical machine production.

Regardless of how difficult your custom molded plastic requirements may be, the surest way to have it done correctly is to submit them to Erie Resistor. The fact that it has never been done is just a challenge for us to find a way to do it.

Plastics Division
ERIE RESISTOR CORP.
ERIE, PENNSYLVANIA
LONDON, ENGLAND . . . TORONTO, CANADA



When is an Institution?

We have always regarded ourselves as a small business. From the time that we started some quarter century ago, we have tried to maintain a service for our customers—plainly and simply, a sort of molding department which would mesh with their requirements and their procedures.

That talk about building a better mouse trap may or may not be true—all we know is that in spite of our original desire to stay small, we have had to grow to keep pace with our customers. We seem to have more and more of them and they seem to be growing, too.

Part of the service we offer customers — and prospects—and friends —is this booklet "A Ready Reference for Plastics." Copies are sent free to companies writing for it.

Physically, Boonton is now a sizable molder. We have lots and lots of presses, mold making equipment, finishing equipment. A lot of it is special stuff built to meet special needs. We have even developed our own automatic compression press, a sort of robot which turns out large quantities of small moldings.

Some people have begun to refer to Boonton as the typical molder—we seem to be becoming a sort of institution.

Frankly, we don't like it. We are still a small business in attitude, even though our facilities may have been expanded. We still do business on a personal face to face, man to man basis. We still like to make an honest profit, openly arrived at.

We still give our customers what they pay for.

If you would like to do business on these bases, we don't think you can do much better than coming straight to Boonton.

BOONTON MOLDING COMPANY

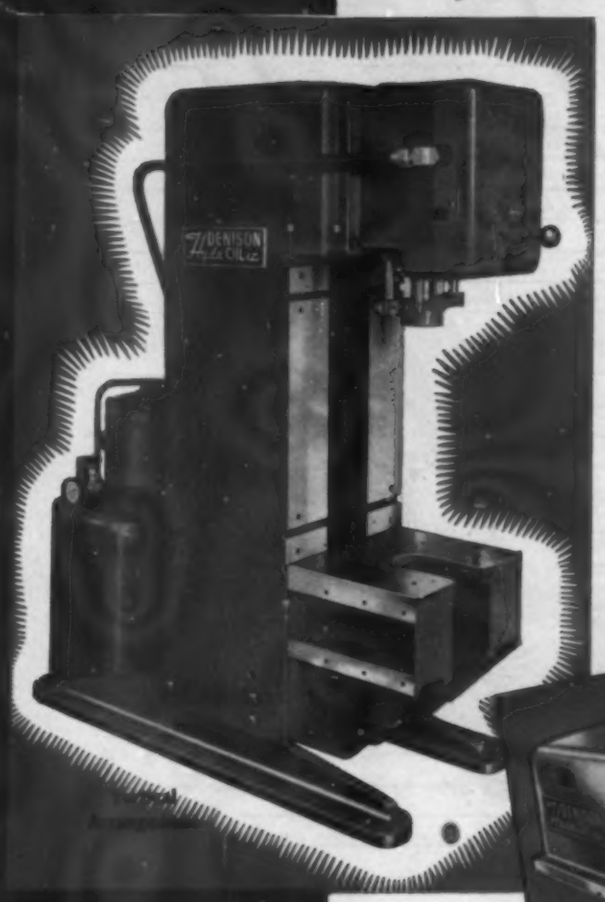
MOLDERS OF PLASTICS · PHENOLICS · UREAS · THERMO PLASTICS

BOONTON · NEW JERSEY · Tel. Boonton 8-2020

NEW YORK OFFICE

Chanin Bldg., 122 East 42nd Street, New York 17, N. Y., MUrray Hill 6-8540

Radically NEW Design
MULTIPLIES PRESS FLEXIBILITY!



MULTI-UNIT Hydroilic PRESS

A news-making improvement in machine tool design! A Denison hydraulic press built in separate, self-contained, specially designed components that achieve two striking advantages! First, they combine into the highly flexible MULTI-UNIT press, which can be set up in a variety of ways to meet many different needs. Second, your engineers can quickly and economically adapt individual MULTI-UNIT components to your own special machines or equipment!

Inclined 10 or 20 Degrees

Standard Frame

Horizontal Arrangement

MULTI-UNITS include the Pumping Unit, Power Head, Standard Frame, and Bolster. The Power Head, available in seven models, offers an amazing variety of ram actions, including manual or automatic control, rapid traverse and regulative pressing speed, automatically repeated pressure strokes, automatic ram cycling, and the now-famous Vibratory HydrOILic Pressure. Ram pressures are closely limitable up to 4 or 6 tons. Ram strokes are regulative between ⅛ inch and 6 inches.

The Standard Frame is drilled and keyed to permit a variety of bolster and Power Head adjustments, and features a choice of legs and "feet" that adapt the press to four different positions—horizontal, vertical, and at 10 or 20 degree inclines. Standard interlocking accessories, such as indexing tables and ejection cylinders, are applicable to these Multi-Units.

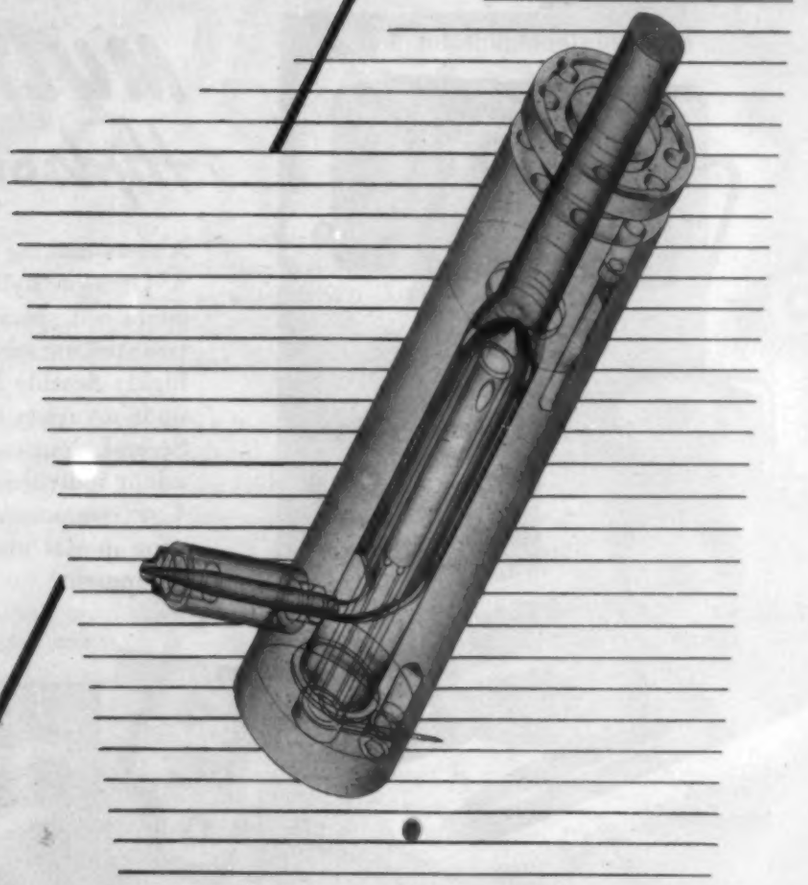
Write today for full details on this sensationally new production aid!

The DENISON Engineering Co.
1176 Dublin Rd.
Columbus 16, Ohio

HydrOILics DOES IT RIGHT

DENISON EQUIPMENT in APPLIED Hydr ics

INJECTION MOLDING



TAKES A STEP FORWARD

In the injection molding process, it is primarily the heating and injection system of the machine which makes the difference between efficient and inefficient operation. Heat input, horsepower consumed, cycling speed, molding quality, reject percentage—all depend largely upon the performance of the injection cylinder, "the heart of the machine". Leading plastic molders* have tested the new Lester internally heated solid-plunger injection cylinder under the most severe working conditions, and have reported production increases up to 40 percent, reject percentages cut as much as 75 percent, and temperature reductions as great as 135 degrees, along with distinctly better plasticization. Don't these facts stimulate *your* curiosity? Write us for complete data.

*Names on request.

INJECTION MOLDING MACHINES

Distributed by **LESTER-PHOENIX, INC.**

2711 CHURCH AVE., CLEVELAND 13, OHIO

FIRST CHOICE

DETROIT MACOID is first choice of many of America's leading industrial concerns as their source of extruded plastics.

MACOID was, of course, first in the field. We invented the process of modern dry plastics extrusion and we built the first machines to do the work.

MACOID has become famous for its progressive, daring application of plastics extrusion to the requirements of all industries. So many "firsts" have come from MACOID that the name has become synonymous with leadership in all fields.

MACOID engineers are ready to work with yours on any and all plastics extrusion requirements. In addition to our custom work, we have a complete range of stock extruded shapes in both rigid and flexible materials.

We also do injection molding.

DETROIT MACOID CORPORATION

12340 Cloverdale Ave.
Detroit, Michigan

SOCIETY OF THE PLASTICS INDUSTRY · SPI

ORIGINATORS OF
DRY PROCESS PLASTIC EXTRUSION

....YOU BENEFIT

from the Experience and Techniques that Produced This Molded Rotor

PRODUCT IMPROVEMENT through the proper use of plastics is a specialty with our organization. In producing the molded rotor shown above, difficult service requirements were met by combining plastics and metals. This called for molding techniques that can be applied advantageously to many products intended for peacetime use.

During the war years, plastics had to justify selection through superior performance in service. Molding experience and skills developed and improved during that period are now available to you through Plastic Manufacturers.

If you seek product betterment, we may be able to help you. We have the latest equipment for injection, transfer and compression molding. Our production is varied, from simple molded parts, produced in volume on high-speed injection presses to intricate assemblies, transfer molded with inserts. For information on our plastics services, write for Folder File MP 3.

PM REG. U.S. PAT. OFF.

PLASTIC MANUFACTURERS

INCORPORATED

STAMFORD, CONNECTICUT

MOLD MAKING • INJECTION & TRANSFER MOLDING • COMPLETE ASSEMBLY

Representatives: DETROIT 2—805-06 New Center Bldg. • LOS ANGELES 35—1440 So. Robertson Blvd.

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cellulose in its purest commercial form

CHEMCOT chemical cotton is processed from cotton linters, * to meet the varied and exacting specifications of manufacturers of cellulose products. CHEMCOT is a "custom made" cellulose processed by design to remove all offending impurities, and also to preserve a natural high degree of polymerization. When you plan new products that require a cellulose base, or if you want to improve present products — CHEMCOT (Cellulose in its purest commercial form) will justify your careful investigation.

CHEMCOT CHEMICAL CHARACTERISTICS

High Alpha Cellulose—99%
Degree of Polymerization—As Required
Controlled Mineral Content
Low Ash
Uniform Reactivity

CHEMCOT PHYSICAL FEATURES

Absorbent
Bright
Clean
White
Fibrous

CHEMCOT is currently used for high grade rayons, films, plastics, laminates and papers.

Loose Form **Sheets** **Rolls**

We cordially invite your inquiry and will gladly supply research samples and further information about CHEMCOT

*** Prime cotton fibres removed from cottonseed after ginning.**

SOUTHERN CHEMICAL COTTON COMPANY
CHATTANOOGA 10, TENNESSEE

DURITE

PHENOLIC PLASTICS

Camera, Courtesy Argus, Inc.

MOLDING COMPOUNDS

ADHESIVES & CEMENTS • INDUSTRIAL RESINS

DURITE PLASTICS INCORPORATED • 5000 Summerdale Ave. • Philadelphia 24, Pa.

APPLICATIONS OF THERMATRONIC HEATING...

- Curing rubber and tobacco
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- Drying paper and textiles
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- Destroying grain infestations
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- Polymerizing resin
- Sealing or Bonding Thermo Plastic products
- Seasoning lumber
- Sterilizing

Thermatron

PROVIDES MORE HEAT...FASTER... PER DOLLAR

The amazing results obtained with Thermatronic heating are revolutionizing production methods in a wide number of diversified industries for the simple reason that it does the job better, faster and at lower cost.

SEALING...WELDING...BONDING

Radio Receptor Co., Inc., pioneer in the field, has developed three power-packed models [illegible]

[illegible]

RADIO RECEPTOR COMPANY, INC.

Since 1922 in Radio and Electronics

251 WEST 19th STREET NEW YORK 11, N. Y.

Visit our booth number [illegible] at the S.P.I. plastics show, Grand Central Palace, April 22 to 27.

Write for your copy of "Electronic Heating With the Thermatron," our new booklet, describing how to make use of this new powerful electronic force to lower costs, to speed production, to develop new products — a comprehensive, practical guide to the application of electronic dielectric heating.

Metaplast Processes for METAL DEPOSIT ON PLASTICS

DESIGN PLATING
Intricate designs plated on any sized flat lucite or plexiglas to simulate inlays.
SHINY SPRAY
Shiny gold or silver sprayed on plastics, glass, wood, etc. Shiniest finish imaginable without buffing.
PLASTIC MIRRORING
Lucite or plexiglas mirrors as perfect as glass mirrors. Sheets or molded pieces either completely mirrored or design mirrored.
METAPLATING
Plastic plating on small or large pieces. Latest developments provide a thin adherent metal coating. Large scale production at low cost.

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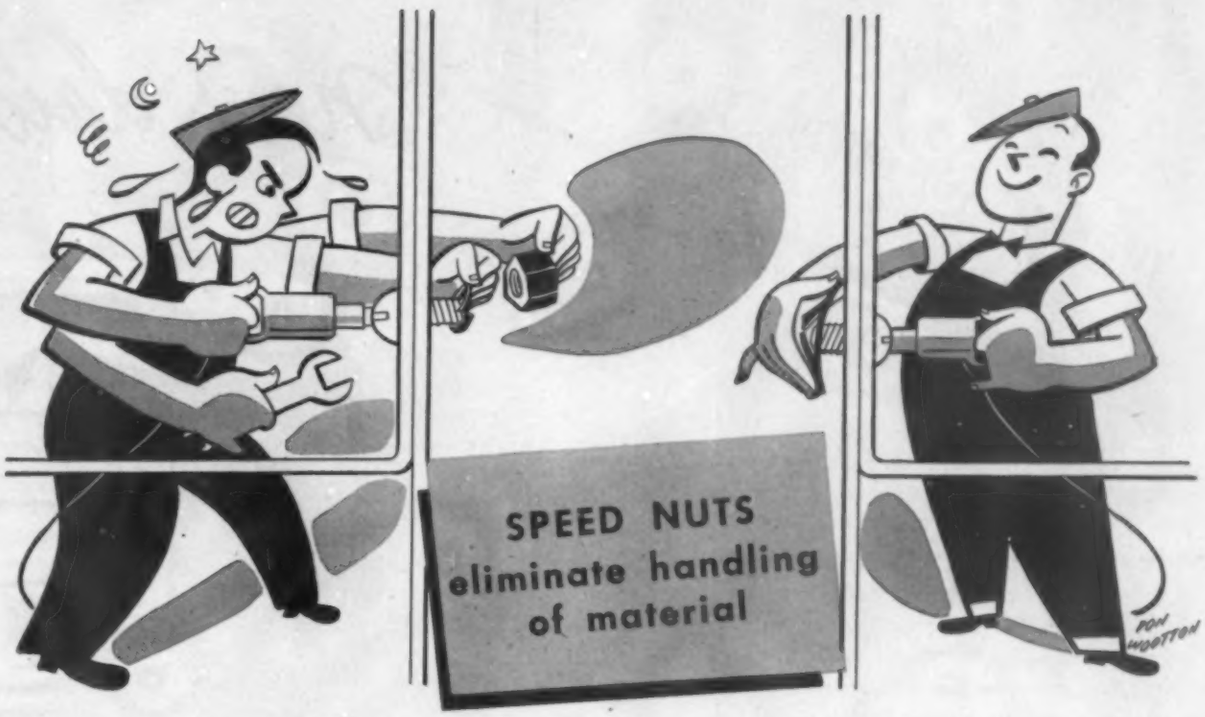
METAPLAST PROCESS PATENTED AND LICENSED
...Seward, Los Angeles 38 • ENGLAND • FRANCE • CANADA • ARGENTINA • BRAZIL • AUSTRIA

METAL PLATING ON PLASTICS

It takes a 4-arm man to keep up with a SPEED NUT Assembler



And even with 4 arms, we'll wager he couldn't keep up. For it stands to reason a man just can't handle a lock washer, threaded nut and a wrench as fast as he could handle a Speed Nut alone.

You don't need lock washers with Speed Nuts, for Speed Nuts are self-locking. The arched prongs and base build up a double, spring tension lock as the Speed Nut is tightened down . . . definitely preventing vibration loosening.

You don't need a wrench with Speed Nuts because slight finger pressure is sufficient to keep them from turning as they are pulled down tight.

All this adds up to worth-while savings, when you stop to think how many nuts, bolts and screws are used to assemble your product. And don't forget, you won't have to buy lock washers, or provide means for stocking them.

Surely you're interested in reducing your assembly costs without reducing the quality of your product. So write us today for literature or send in your assembly details.

TINNERMAN PRODUCTS, INC.
2048 FULTON ROAD, CLEVELAND 13, OHIO

In Canada: Wallace Barnes Co., Ltd., Hamilton, Ontario
In England: Simmonds Aerocessories, Ltd., London
In France: Aerocessoires Simmonds, S. A., Paris
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Speed Nuts* PATENTED

MORE THAN 3000 SHAPES AND SIZES

*Trade Mark Reg. U. S. Pat. Off.

FASTEST THING IN FASTENINGS

DOW

new drive

What makes products sell? As peacetime production swings upward, that question requires close re-examination by everybody making plastic products. Selling is again of paramount importance.

Dow believes that it is the superior properties of quality plastics like Styron that make products sell. Styron's dimensional stability and acid resistance recommend it for rugged products like batteries. Its easy moldability and low water absorption give it the call for refrigerator parts. Its brightness and clarity even make it worthy of costume jewelry and containers for fine cosmetics. And Styron proved in many tough wartime applications that it is the name you can *depend* on in plastics.

Every manufacturer hopes for materials that bring ease and speed to production, better low-cost products, increased profits and prestige. Styron is such a material.

This and other Dow plastics—Styraloy, Ethocel, Saran—demand new appraisal for many products of growing peacetime industries. Now that the war is over, you're on your own in a new bid for markets. A call to any Dow sales office will help insure your future with better products.

Styron's brilliant clarity, low moisture absorption and stability at low temperatures make it broadly useful in ice compartment doors and other refrigerator parts.

Styron's excellent electrical properties, resistance to acids and dimensional stability meet requirements for battery cases.

Closures are a recommended use for Styron because of its wide range of chemical resistance and low moisture absorption.

Tea strainers demonstrate the adaptability of Styron to a variety of products in which it is used in combination with metals.

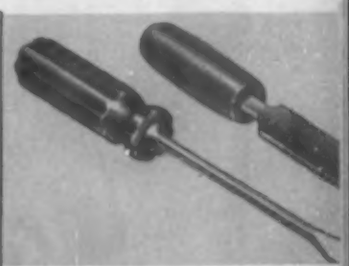
VPLASTICS

e toward better products!

STYRALOY

Styraloy is a new Dow development. It is now being produced in a wide range of formulations from the relatively soft and flexible to the hard and rigid. Its properties recommend it for electrical insulation, communications equipment, better-grip tool handles and many other products.

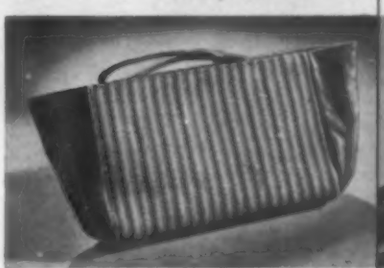
Cable cover of Styraloy gives flexibility, high dielectric strength.



Styraloy in a rigid formulation makes shock-resistant tool handles.

SARAN

This Dow product is a plastic-of-all-trades. It is making chemically-resistant pipe and tubing; colorful, rustproof screen; and textile monofilaments for fabrics that offer new possibilities in color and wearing qualities. It is also used in coatings and finishes.



Handbags of Saran offer long wear, bright colors, ease of cleaning.

Saran pipe and tubing resist corrosion and most chemicals, even acids.

ETHOCEL

For durable molded products, Ethocel is the choice of manufacturers in many fields. Ethocel is exceptionally tough and dimensionally stable, under varying climatic conditions and temperatures. It is made transparent or translucent and in a wide range of flow.

Ethocel provides tough, light, colorful cabinets for table radios.

With injection molding Ethocel produces attractive toy telephones.

Let's work it out together

Success in plastics is measured only in end products. It calls for the combined efforts of manufacturers, designers, fabricators, and raw material producers. Dow is ready to do its part. Save time and money—call on Dow and get the most out of plastics.

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland • Detroit
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DOW

PLASTICS

STYRON • STYRALOY • ETHOCEL
ETHOCEL SHEETING • SARAN • SARAN FILM

BOYAR-SCHULTZ

No. 1 Profile Grinder

. . . for Fast, Accurate Removal of Rough Gates and excess Flash from Plastic Parts

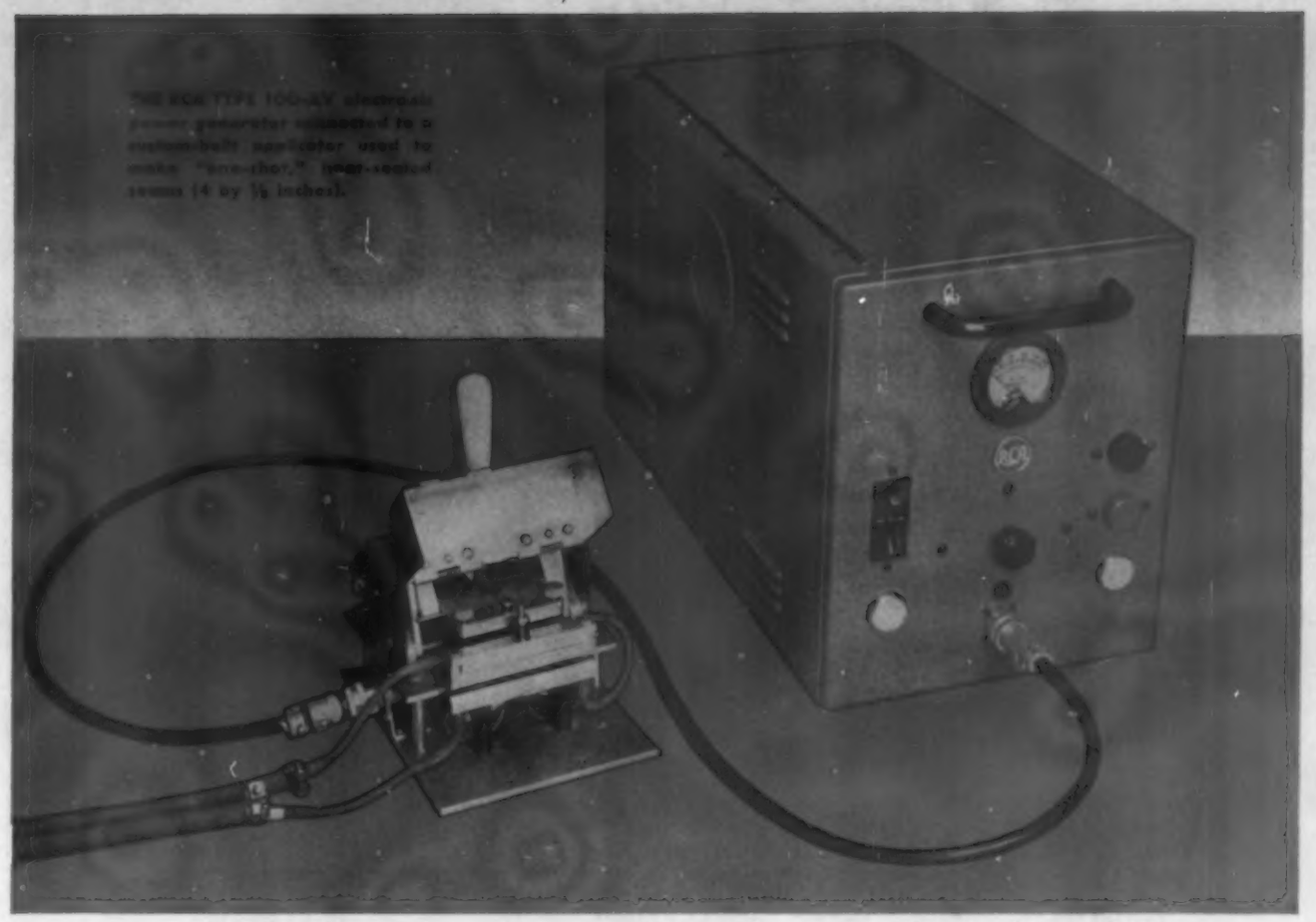
Workers in Plastics have long experienced difficulty in quickly removing rough gates and excess flash that sometimes appear on molded plastic parts. Abrasive belts and grinding wheels used for this purpose, quickly load up and cease to function.

Boyar-Schultz No. 1 Profile Grinder, used with high speed burrs or cutters will quickly remove excess material quickly and cleanly. These cutters turning at high speed are self cleaning and long wearing. With this method, frequent and costly changing of belts and dressing of wheels is eliminated.

This Grinder is a double purpose Tool. It is also most valuable in the tool and die shop for grinding intricate profiles and shapes encountered in tool and die making.

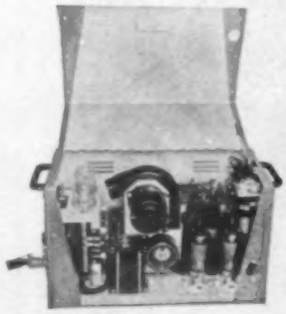
WRITE FOR CIRCULAR

BOYAR-SCHULTZ
CORPORATION
2115 WALNUT STREET • CHICAGO 12, ILLINOIS



AN RCA ELECTRONIC POWER GENERATOR

especially designed to speed small heat-sealing jobs



By opening the hinged top and side cover, every part is right at your fingertips for easy inspection.

Here's a handy device for heat-sealing small seams* in articles being fabricated from thermoplastic film materials.

It is unusually compact (12″ high, 10″ wide, 20″ long) and weighs only 80 pounds. Two carrying handles add to its portability.

This generator has a power output of 150 watts (50 per-cent duty cycle) and 100 watts (continuous duty), operates at 200 megacycles, and can be plugged into any 115-volt, 60-cycle, single-phase power supply.

It has a built-in automatic timer which provides accurate time intervals ranging from ¼ second to 15 seconds—ideal for production-line jobs. A switch enables selection of *automatic* or *manual* timing. A pin jack on the control panel makes it easy to add remote-control switching.

To assure long life, a small blower supplies cooling air to the electron tubes and other parts within the cabinet. Automatic relays protect the tubes and apparatus against improper operation and overloads.

A few now in stock—If you will let us know, at once, of your requirements, you can get one or more of these handy, time-saving electronic generators immediately.

For further data, write or call RCA, Dept. 55-C, Electronic Apparatus Sec., Camden, New Jersey.

*Recommended active area of the electrodes, one square inch or less.

ELECTRONIC HEATING

RADIO CORPORATION of AMERICA

ENGINEERING PRODUCTS DIVISION, CAMDEN, N. J.

There's no "coin-flipping" substitute for experience in plastics, regarding . . .

CHOICE OF MATERIALS

IT MUST BE RIGHT!

A good molder is more than just an "order-taker"—he should have the necessary experience to select the proper plastic material for the job. Using the correct compound—and designing the best mold to process it—require long and varied experience. It is this ability that is identified with sound plastic production . . . that will insure the best possible measure of success in building a satisfactory, saleable product.

MACK MOLDING COMPANY—serving industry for over a quarter century—has had the necessary experience in the design and production of molded plastics.

This experience is available to you, and, in the planning phase, we shall frankly tell you if plastics are practical or impractical for your purpose. Our eight-page brochure will enlighten you concerning both the intricacies of plastics and the broad scope of MACK MOLDING facilities. Write for it today.

For Molded Excellence

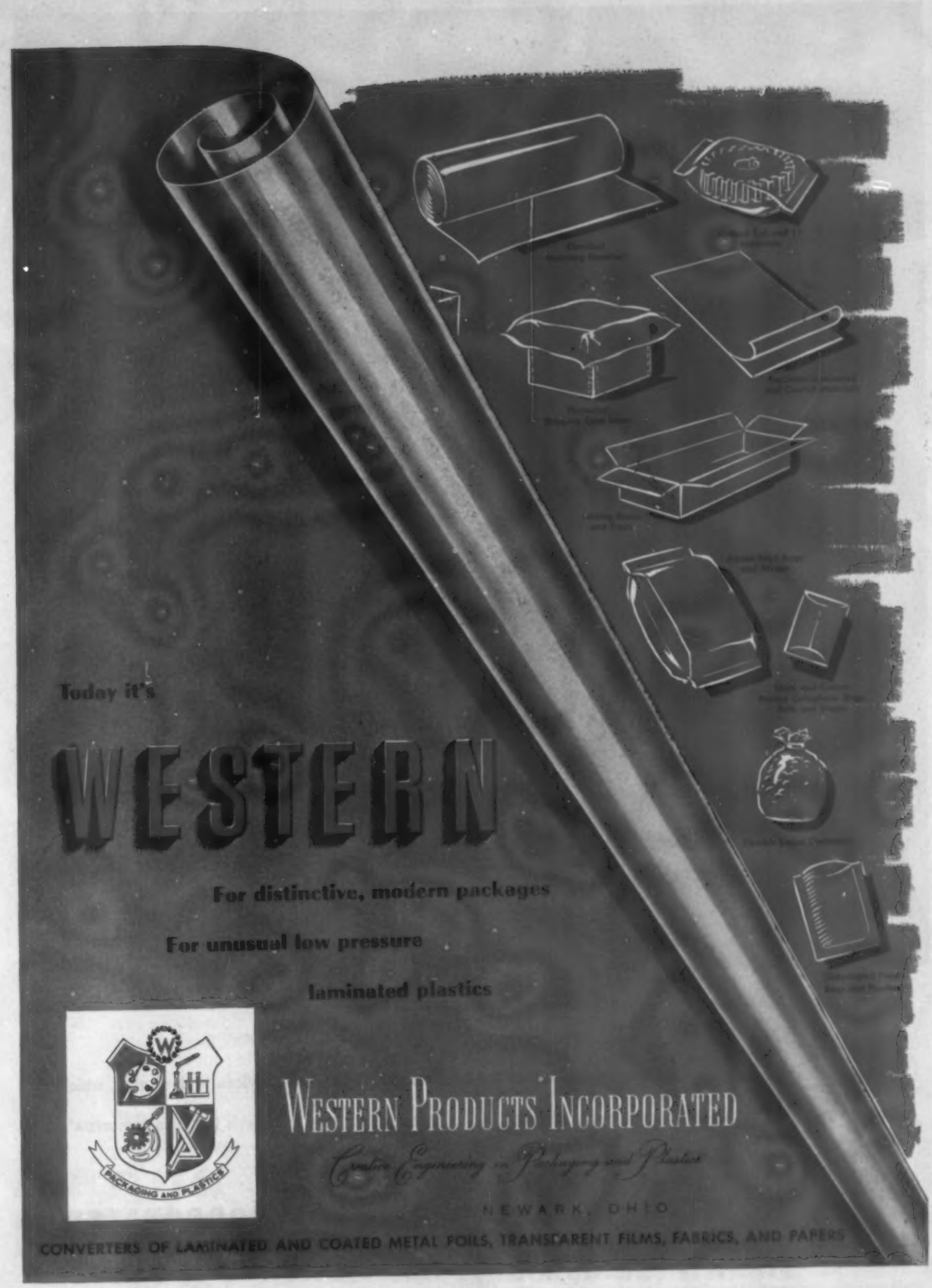
★

Mack

MACK MOLDING COMPANY

120 MAIN STREET, WAYNE, NEW JERSEY

SALES OFFICES: NEW YORK, CHICAGO, DETROIT, INDIANAPOLIS, BOSTON AND ST. LOUIS


Today it's
WESTERN
For distinctive, modern packages
For unusual low pressure
laminated plastics
PACKAGING AND PLASTICS
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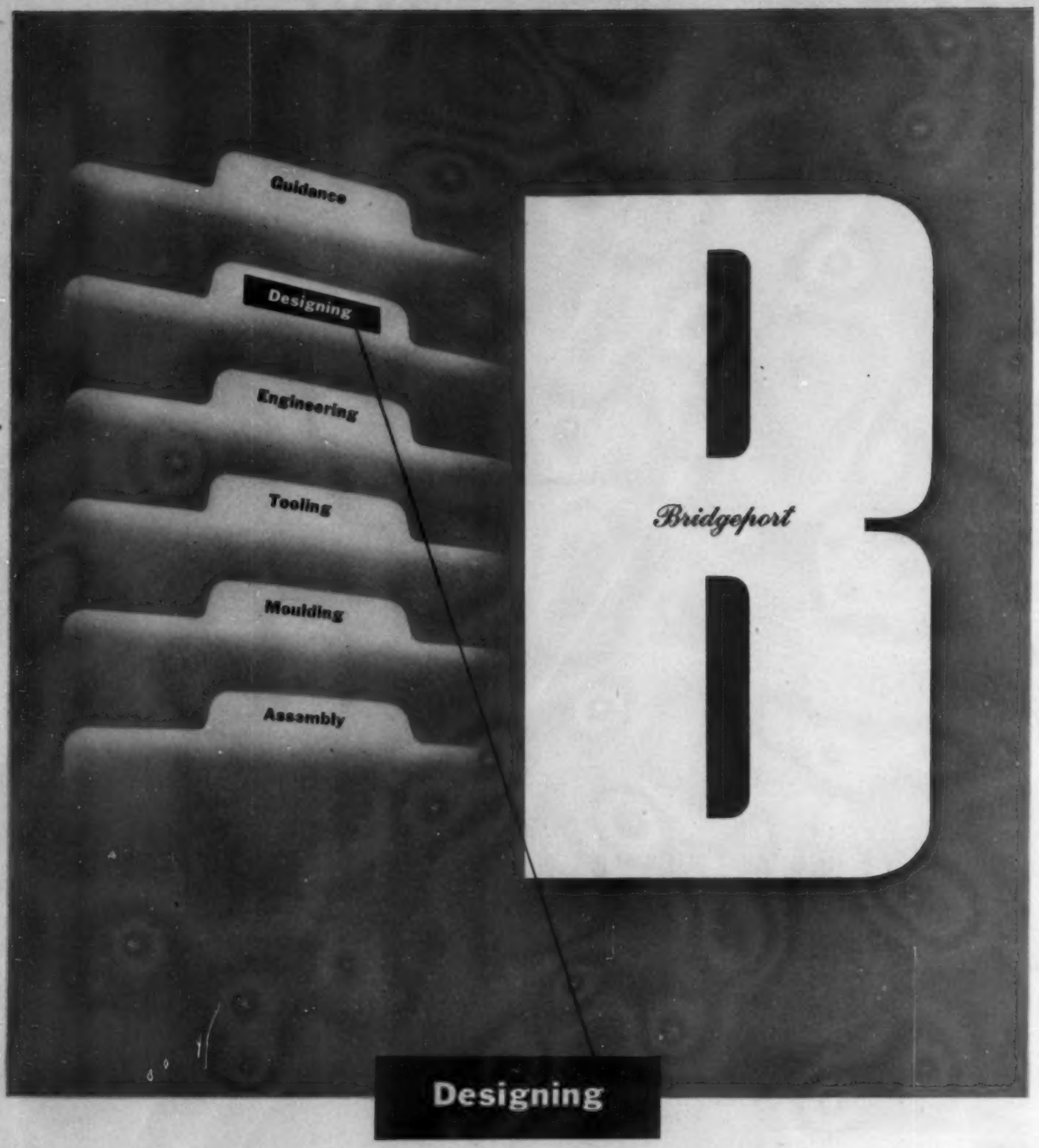
Creative Engineering in Packaging and Plastics
NEWARK, OHIO
CONVERTERS OF LAMINATED AND COATED METAL FOILS, TRANSPARENT FILMS, FABRICS, AND PAPERS



Today's market looks for and demands the last word in design. Among our services is designing, which offers your product added sales appeal—enabling you to compete not only in today's but also tomorrow's market. For plastics, think of Bridgeport.

BRIDGEPORT MOULDED PRODUCTS, INCORPORATED

BRIDGEPORT B CONNECTICUT

Hanna *Control Valves*

for efficient control of air and hydraulic cylinders

. . . Hanna Unitite Junior ¼" Control Valves

These Unitite Juniors have the same functional design as the well-known Hanna Unitite Valves. Designed as 4-way valves, they can be used as 3-way valves by plugging one port. Unitite Junior Control Valves are suitable for air, oil or water pressures to 250 p.s.i. The handle movement is 80° for complete reversal.

Precision built, packless and permanently tight, Unitite Juniors are ideal for operating small pneumatic or hydraulic cylinders or as pilot controls for larger valves. Available in 3 mounting styles. *Write for literature.*

. . . Hanna two-direction Speed Control Valves

This valve installed between the operating valve and one end of a cylinder provides adjustable control of inflow as well as outflow of the air or oil independently to and from one side of the piston.

One valve will therefore control the piston speed in two directions. One valve is always sufficient for oil operation, but when most effective control of an air cylinder is desired, two valves, one for each end of the cylinder, are used.

Hanna Speed Control Valves are made for working pressures of 250 pounds for air cylinders and 1,000 pounds for hydraulic. Available in ¼", ⅜", ½", ¾" and 1" pipe sizes. *Write for literature.*

. . . Hanna foot operated Valves

Hanna Foot Valves provide quick, almost effortless control —free hands for holding work, feeding or removing pieces, and all the other things that hands alone must do. Consider Hanna Foot Valves wherever possible. They will speed work, increase efficiency, reduce operator fatigue. Soundly designed for foolproof operation, sturdily built of quality materials—Hanna Foot Valves will prove a worthy part of any machine or operation where they are used. Available in single and double pedal models in ⅜", ½", ¾" and 1" pipe sizes. *Write for literature.*

Hanna Engineering Works

hydraulic and pneumatic equipment . . . cylinders . . . valves . . . riveters

1765 Elston Avenue, Chicago 22, Illinois

Twin 1.

RADIO FREQUENCY PREHEATING

...A NEW ALLY TO DO IT BETTER

The achievements of radio frequency preheating in plastic molding show impressive gains right down the line. Combining r.f. preheating and high-speed plunger molding accomplishes astonishing results. Production soars 20% over conventional methods. Curing time drops 91%. Mold life increases 30%, while mold costs are cut by 67%.

And the flexibility of r.f. preheating adapts it perfectly to a wide range of molded products. It is ideal for making parts with long, slender holes because the reduced pressure does not bend or break mold pins. Metal inserts can be molded better by the r.f. preheating technique.

In molding thick phenolic laminates, r.f. heating substantially reduces the possibilities of overcuring and results in marked improvements in physical characteristics.

Standard Westinghouse ratings are available from 2 to 20 kw, and up to 200 kw if your application requires that much power. Get all the facts from your nearest Westinghouse office. Or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

X-RAY, TO LOOK INSIDE AND KNOW IT'S BETTER

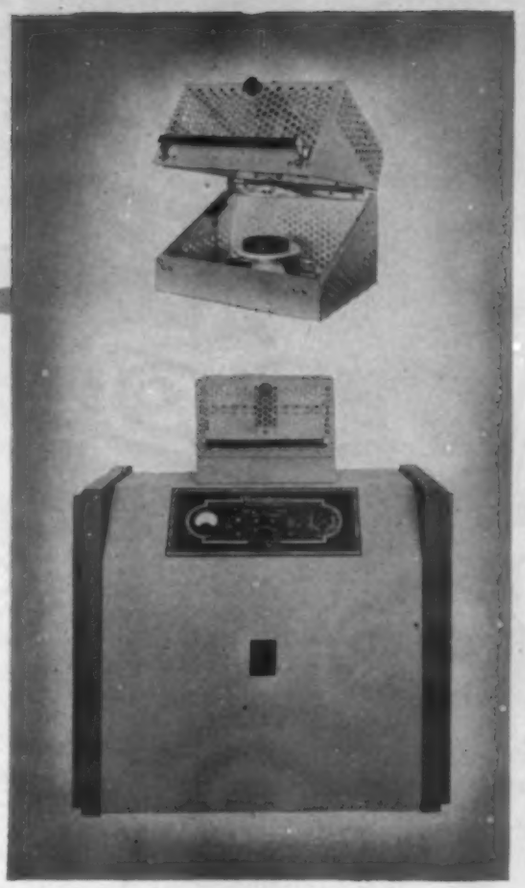
Now you can look inside plastic and small metal parts, right on the production line.

For the Westinghouse Productograph, a new x-ray tool for internal inspection of small parts, will insure structural uniformity and eliminate rejection of finished units due to hidden weaknesses.

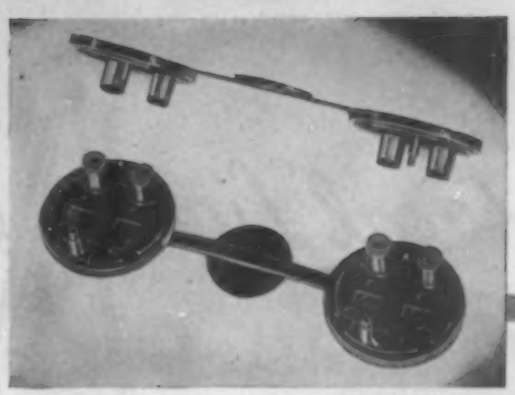
Compactly packaged and self-contained, the Productograph is entirely ray-proof. No need for expensive lead-lined rooms for the protection of operating personnel . . . thus providing two important savings:

1. Saves personnel time. Operators work freely in close contact with unit without fear of x-radiation.
2. Saves production time. Smooth flow of products is accelerated by faster, easier handling.

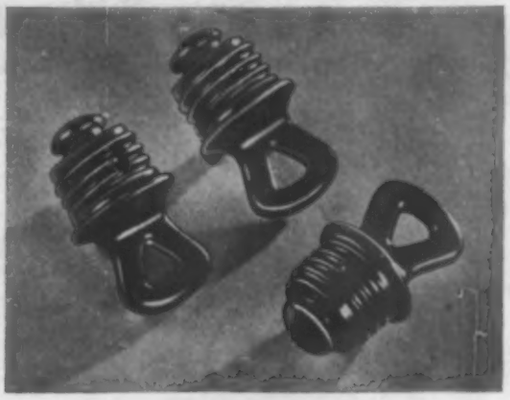
Operation is highly flexible . . . either automatic or manual, depending upon the type and quantity of products to be inspected. Your nearest Westinghouse office can give you complete details on the contributions of this electronic tool to improve plastic production. Or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-08140



Electrode assemblies like this are mounted easily on standard Westinghouse generators. Available in electrode diameters from 4" to 15", depending upon rating.



Cycle time for these meter box covers was cut from 5.42 minutes to 46 seconds by r.f. preheating!



10-cavity molds with r.f. preheating produced more stoppers than 50-cavity mold under old process.

Productograph may be installed right on production line. Eliminates expensive lead-lined rooms. Speeds handling.

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Electronics at Work

Local Light for Better Sight . . DAZOR ALONE *Floats!*

There's no margin for error in such critical tasks as precision machining, fine inspection, bench and assembly work. And none in drafting, accounting, bookkeeping. These jobs—and many others—demand straight seeing!

Use local light for better sight . . . Dazor *Floating* Lamps. For Dazors bring all-around *flexibility* to individual working areas, giving users full control over both the location and intensity of illumination.

A touch of the hand does it—*floats* the lamp to virtually any position where it *stays put* without further attention. This freedom of movement results from the *floating arm,* an exclusive patented Dazor development.

An investment in Dazor *Floating* Lamps will come back to you many times in higher worker efficiency and morale, in the quality and quantity of work produced, in the prevention of errors, accidents and waste.

Phone Your Dazor Distributor

. . . get from him the full Dazor story, application assistance and an on-the-job demonstration. Your distributor's name, if unknown to you, can be secured by writing to the Dazor Manufacturing Co., 4483 Duncan Ave., St. Louis 10, Mo.

IN CANADA address inquiries to Amalgamated Electric Corporation Limited, Toronto 6, Ont.

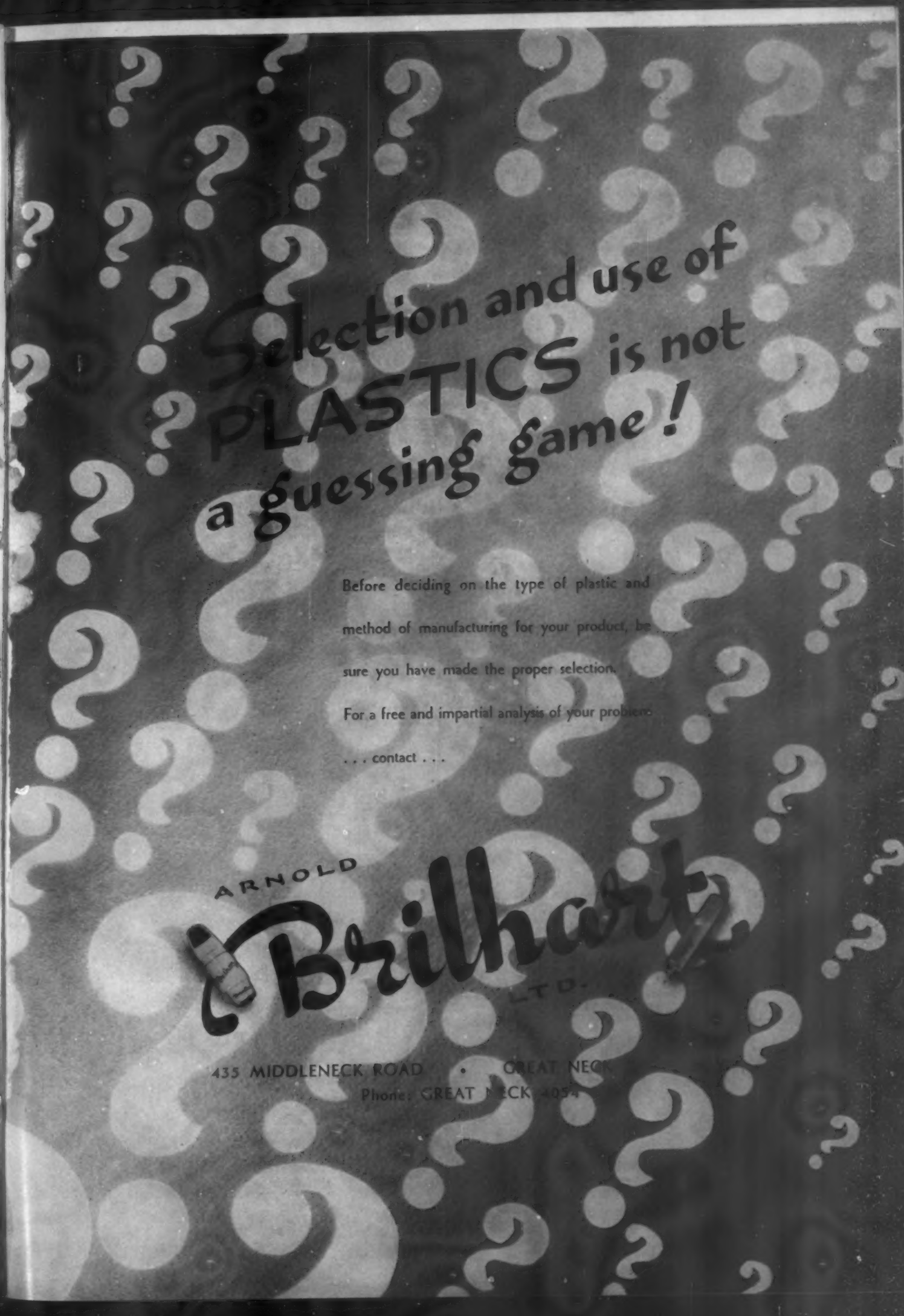
Precision machining is made easier, more certain with precise Dazor lighting.

Controlled Dazor lighting helps this dispatcher control train movements.

Intense Dazor illumination is here directed exactly where welder needs it.

DAZOR *Floating* LAMPS

FLUORESCENT *and* INCANDESCENT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PLASTICS is not
a guessing game!
Before deciding on the type of plastic and method of manufacturing for your product, be sure you have made the proper selection.
For a free and impartial analysis of your problem
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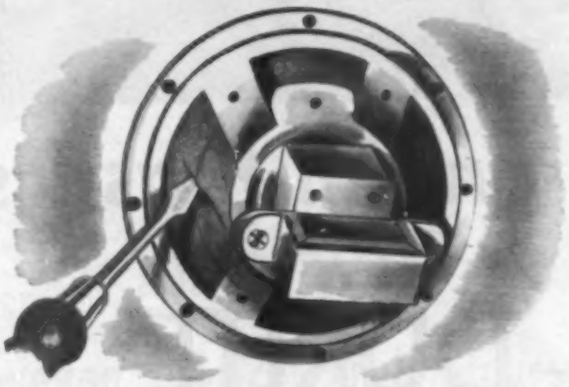
INDEPENDENT INVESTIGATOR'S STUDY SHOWS

How Phillips Screws Saved Emerson Radio $40 Daily Spoilage

THIS INVESTIGATOR from James O. Peck Co., industrial research authorities, is visiting a number of representative plants to get authentic FACTS on assembly savings for you.

GET HIS UNBIASED REPORTS READ THE COMPLETE FACTS!

100 Driver Skids a day eliminated ... at 40¢ a skid!

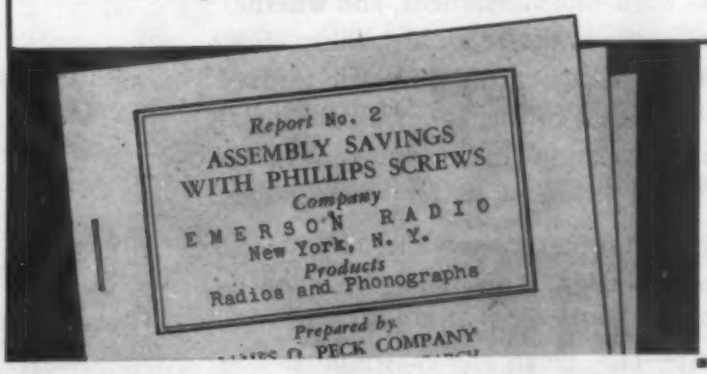


EMERSON RADIO & PHONOGRAPH CORP. use Phillips Screws for one good reason... *they cut costs!* Good example is the daily saving of $40 formerly used up reclaiming loud speaker cones ruined by driver skids from slotted screws.

That's only one way Phillips Screws save. They can be driven faster – allow use of power in place of hand drivers. They drive tighter – fewer and smaller screws can often be used. Burrs and broken screw heads are eliminated, and the ornamental design improves product appearance.

NOW, THESE UNBIASED REPORTS show how these advantages result in savings that add up *big* in yearly assembly records – savings you can't afford to miss with today's squeeze on profits.

THE ASSEMBLY STUDIES COVER ALL TYPES OF PRODUCTS – metal, plastics, wood. The report on Emerson – others now ready – and more to come – make up a practical manual of modern assembly methods, never-before-printed information, inside facts you'd pay good money to get, – and it's yours, now, FREE!



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Find out how industry's best assembly experts cut costs! Get these reports, as they are issued. Don't wait... mail the coupon TODAY!

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For *All* Sanding

on *All* Plastics

One Word–DURITE

It's as simple as that! For sanding dry, it's Durite; for sanding wet, it's Speed-wet Durite. But dry or wet, it's one word—Durite.

The rigid plastics are all hard, horn-like substances, and whether thermosetting or thermoplastic, they require a hard, sharp abrasive. Next to the diamond itself, silicon carbide, electric furnace abrasive, is the hardest and sharpest cutting agent. Durite abrasive belts are coated with silicon carbide grain—glue bonded for dry sanding—waterproof bonded (Speed-wet) for wet sanding.

Removal of gates and flashes and restoration of true mold lustre are "necessary evils" of mold design. They must be done as "painlessly" as possible. Durite belts have the speed and cut to finish plastics just that way—fast, clean and cost-minus.

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For your convenience we have made up a book of sample fabrics representing 12 different constructions. These samples indicate a range of woven fabrics we are in a position to supply. Within each range are many variations of widths, weights, etc., and in the thousands of fabrics made by the mills we represent you will find the fabric best suited to the requirements of your own plasticizing process. In addition to standard constructions, we develop fabrics to specifications.

WELLINGTON SEARS COMPANY SELLING AGENTS
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are all exceptionally pure...and of an even, fluffy texture. Free from all traces of "greasy" lumps, surface qualities of Witco Stearates make them remarkably effective as lubricants in plastic molding. Witco Barium Stearate has the additional advantage of an extremely high melting point, permitting its use in high-heat operations where other lubricants would liquefy and drain off. All Witco Stearates—Aluminum, Barium, Calcium, Lead, Magnesium and Zinc—are products of long research and experience. Send for samples today.
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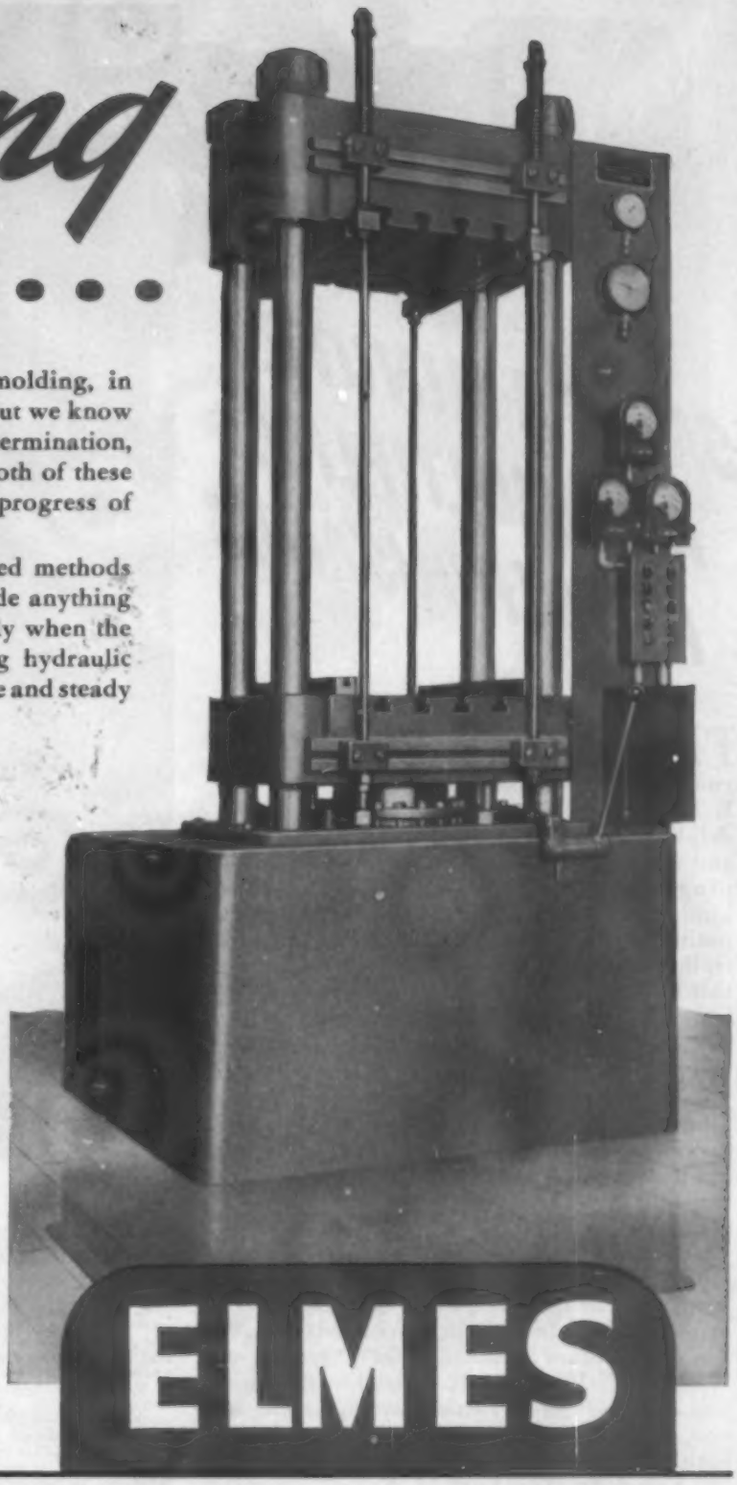
Molding the Future . . .



What will tomorrow bring in plastics molding, in presses? Frankly, we don't know, *exactly*. But we know of no better background for progress than determination, and a reputation for *sound* development. Both of these qualities are amply apparent in the rapid progress of plastics, *and* in Elmes hydraulic presses.

The war's end, in itself, has not obsoleted methods and machines, nor can mere *newness* outmode anything that has gone before. Progress is made only when the new proves *better*. That's why pre-proving hydraulic presses has been a basic factor in molding sure and steady Elmes advancement for nearly a century.

For Plastics

Elmes equipment for plastics molders includes: Presses for compression and transfer molding; Laboratory Presses for development, testing, limited production; Hobbing Presses for precision die sinking; High-Pressure Pumps for sure fluid power; Accumulators that store this fluid power for group press operation . . .

—and an engineering service for developing special machines, or adapting standard designs to unusual, specific purposes. Write for literature on the type of equipment you need, and the name of your distributor.

ILLUSTRATED

A self-contained, 225-ton, Elmes plastics press for deep molds with thin sections. Automatic operating cycle: (1) partial mold closure, with a pause for desired heating time; (2) full closure, followed by a slight reopening for breathing; (3) breathing interval, followed by closure for curing; (4) curing interval, reopening, and return of platen to starting position. Colored lights flash on to indicate occurring stages.

ELMES

Put Your Pressing Problems up to ELMES

ELMES ENGINEERING WORKS
of AMERICAN STEEL FOUNDRIES
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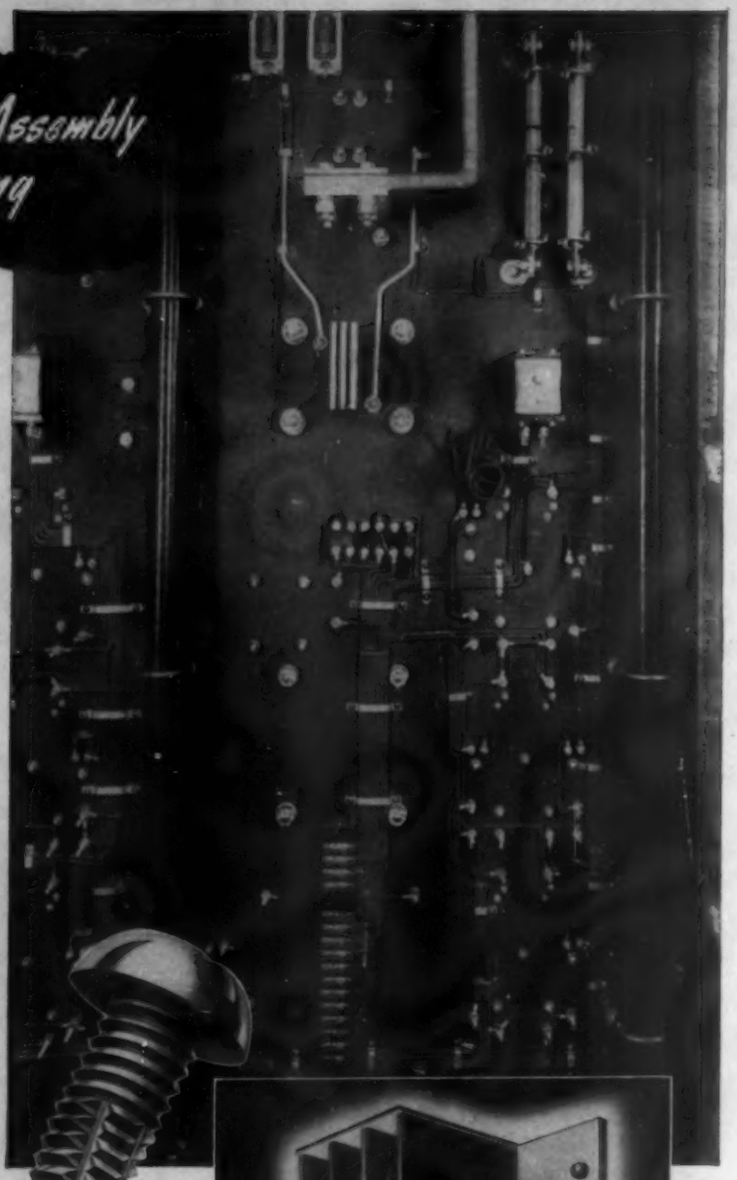
HYDRAULIC EQUIPMENT

METAL-WORKING PRESSES · PLASTIC-MOLDING PRESSES · EXTRUSION PRESSES · PUMPS · ACCUMULATORS · VALVES · ACCESSORIES

Common Sense Assembly Engineering

SAVES A MINUTE... AND MULTIPLIES IT BY THOUSANDS



IT'S CERTAINLY sound common sense to save any assembly time which does not add to your product or your profits. The way the I. T. E. Circuit Breaker Company of Philadelphia saved it . . . in assembling switchboards and circuit breakers. They used P-K Self-tapping Screws everywhere possible, in many kinds of materials. The minutes saved by eliminating individual tapping operations are multiplied many thousands of times in assembling this kind of apparatus. That rates as *common sense assembly engineering!*

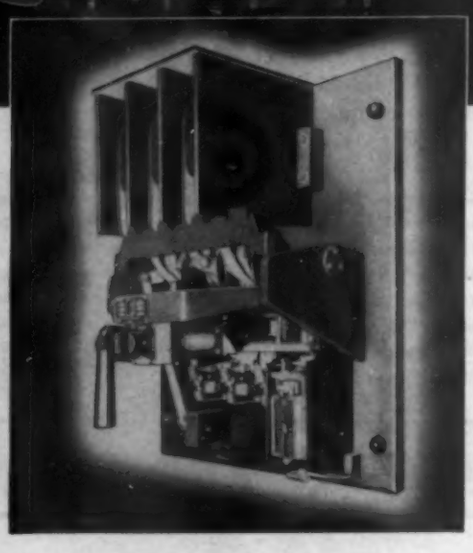
You don't know . . . we don't know . . . whether or not P-K Screws would save you money on *your* assembly job. But we do know that in *7 out of 10* jobs submitted to us, P-K Screws do the job better, for less. Why not find out if your job is one of the lucky seven?

Let a P-K Assembly Engineer prove it

The way one manufacturer makes fastenings with P-K Self-tapping Screws illustrates only a small part of the advantages of these unique fastenings. Maybe your product needs some of the many other advantages of P-K Screws. With the help of a P-K Assembly Engineer you can find out . . . either by his calling on you, or your mailing in assembly details . . . both without obligation. Parker-Kalon Corp., 208 Varick St., New York 14, N. Y.

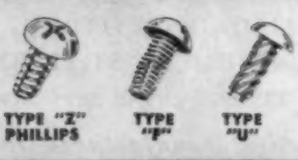
Sold Only Through Accredited Distributors

The P-K Type "F" Self-tapping Screw is used for a multitude of fastenings . . . for wire cleats, insulation, switch covers, name and calibration plates, and even functions as terminals in these I. T. E. switchboards and circuit breakers. It cuts a clean, snug fitting thread as it is driven, and makes secure fastenings in such materials as the slate, ebony asbestos, and bakelite used in these switchboards.



PARKER-KALON

P-K



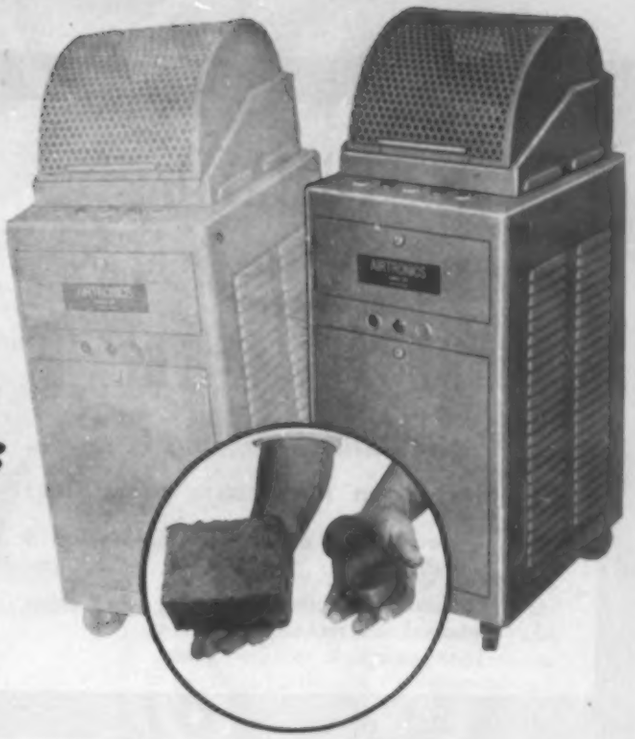
SELF-TAPPING SCREWS

A FASTENING FOR EVERY METAL AND PLASTIC ASSEMBLY

Airtronics*

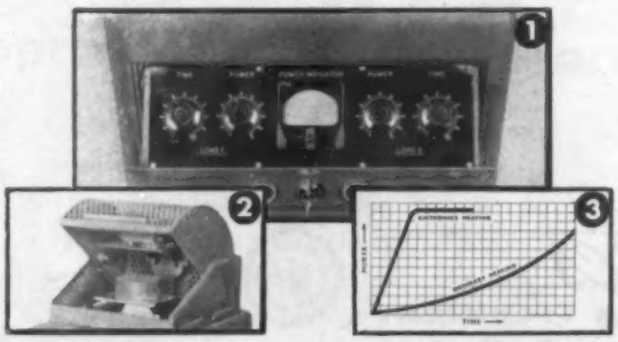
"2 in 1" Operation

Can Double Preheater Capacity



AIRTRONICS Dual Preheaters make possible the heating of two entirely different loads, alternately, or in any sequence, without control readjustments of any kind between heats. This feature frequently *doubles preheating capacity* by permitting virtually continuous operation — one charge being preheated while the preceding charge is molded. The ability of AIRTRONICS Dual Preheaters to do this double job, without intermediate control readjustments, results primarily from the coordination of Dual Set-up Controls, Automatic Load Accommodation, and Automatic Power Regulation. These unique AIRTRONICS design features are described on this page.

AIRTRONICS "2 in 1" operation exemplifies the advanced engineering and close attention to practical molding requirements that have made AIRTRONICS Preheaters the choice of discriminating molders from coast to coast. The AIRTRONICS Dual Preheater series includes *standardized* models from 2 to 10 kw. Contact the nearest AIRTRONICS sales and service office for complete details.



1 Dual Set-up Controls — Dual Set-up Controls permit independent adjustment of power output and heating time for two loads.

2 Automatic Load Accommodation — Self-positioning output electrodes automatically accommodate loads varying widely in shape and size. And regardless of load swelling or other dimensional changes, the upper electrode remains in *contact* with the load throughout the heating interval, preventing arcing between load and electrodes. At the end of the heating interval, upper electrode rises away from load permitting fast, easy removal of the heater material.

3 Automatic Power Regulation — A unique electro-mechanical regulator involving only *one* moving part and *completely free of tubes and relays*, quickly raises preheater power to the preset level and maintains it at that level, regardless of changes in the electrical characteristics of the load.

* Reg. U.S. Pat. Office

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B. Evaluation of current problems, new materials and new techniques.

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Casting of Phenolic Resins Industrial and decorative applications of cast plastics are prominently featured in student projects. Each student is given opportunity to prepare his own molds and castings.

Slush Casting of Thermoplastic Granules Various techniques of slush casting thermoplastic granules are taught. Attractive, light colored hollow-walled objects can be prepared in a relatively short time.

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Plastics
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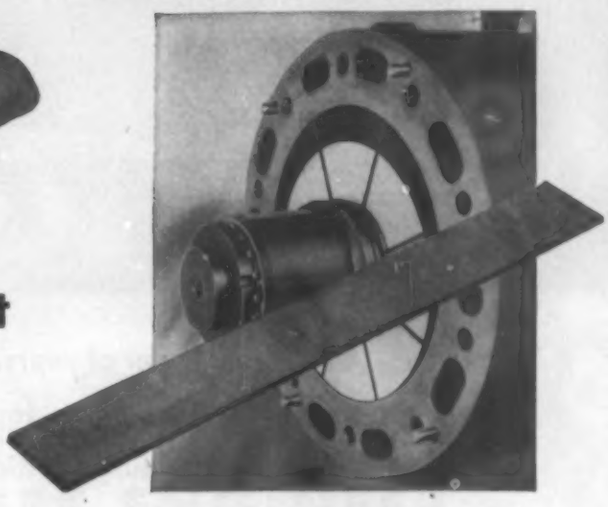
Extremely resistant to heat, the PHENOLITE blades in this rotary air compressor "stand up" successfully and long—even at discharge temperatures of 300 to 320 deg. F. Cross-section and inset shows blade construction.



Durable Light-Weight

PHENOLITE

LAMINATED PLASTIC

improves product performance and efficiency

For rotary air compressor blades—or wherever a *heat-resistant* material is required—Phenolite laminated plastic "stands up" on every count . . . gives improved product performance, efficiently and economically.

This outstanding property, plus its rare *combination* of qualities, makes Phenolite a "natural" for countless industrial applications. Light in weight (about one-half that of aluminum), it is exceptionally resilient and high in impact strength . . . is resistant to abrasion . . . possesses excellent machinability . . . resists moisture and changing humidities . . . and is not affected by solvents and oils.

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MOLDS

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Today, Allied is serving the plastics industry through a department comprised of men thoroughly skilled in quality mold work. Here every specification for accuracy of form and for fine surface finish is met exactly. It is a department that has developed with the industry — that understands what the requirements of the industry are today.

In the future—as in the past—look first to Allied as a most dependable source for the best in plastic molds.

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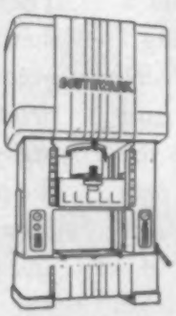
for a BALDWIN PRESS ENGINEER

If you've watched the trend in plant and shop equipment, you know that every year more and more presses have been finding their way into production lines.

Results that once used to require a dozen different shaping, machining and joining operations are now produced by a single thrust of a piston. In addition to economy, the product often gains in strength, appearance and utility because it is formed rather than assembled.

When you're thinking of tomorrow's



products... and tomorrow's competition... the profit and production possibilities of presses are too important to overlook. One of our engineers will be glad to review your manufacturing problem, and suggest the places where a Baldwin Press can help you produce better, faster and more economically in metal, plastics or rubber.

The Baldwin Locomotive Works, Baldwin Southwark Division, Philadelphia 42, Pa. Offices: Philadelphia, New York, Chicago, St. Louis, Boston, Washington, San Francisco, Cleveland, Detroit, Pittsburgh, Houston, Birmingham.

BALDWIN

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HYDRAULIC PRESSES

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from Another "Case History"

Designed and Engineered by ECLIPSE for Practical and Economical Moulding from PLASTICS.

Vacuum Control Gun Handle produced by ECLIPSE

Removing Completed Piece from Injection Mould.

This vacuum control gun handle is a prime example of how ECLIPSE engineers have succeeded in achieving complex precision injection moulding and divergent angular draws. The die for this industrial safety equipment was built so as to mould component parts simultaneously in the same cycle.

The same designing ingenuity and skill that perfected this method of moulding precision parts from plastics for war production is now available for studying your new products with an eye to the practical use of plastics. The know-how of Eclipse engineers, designers, and stylists is at your service.

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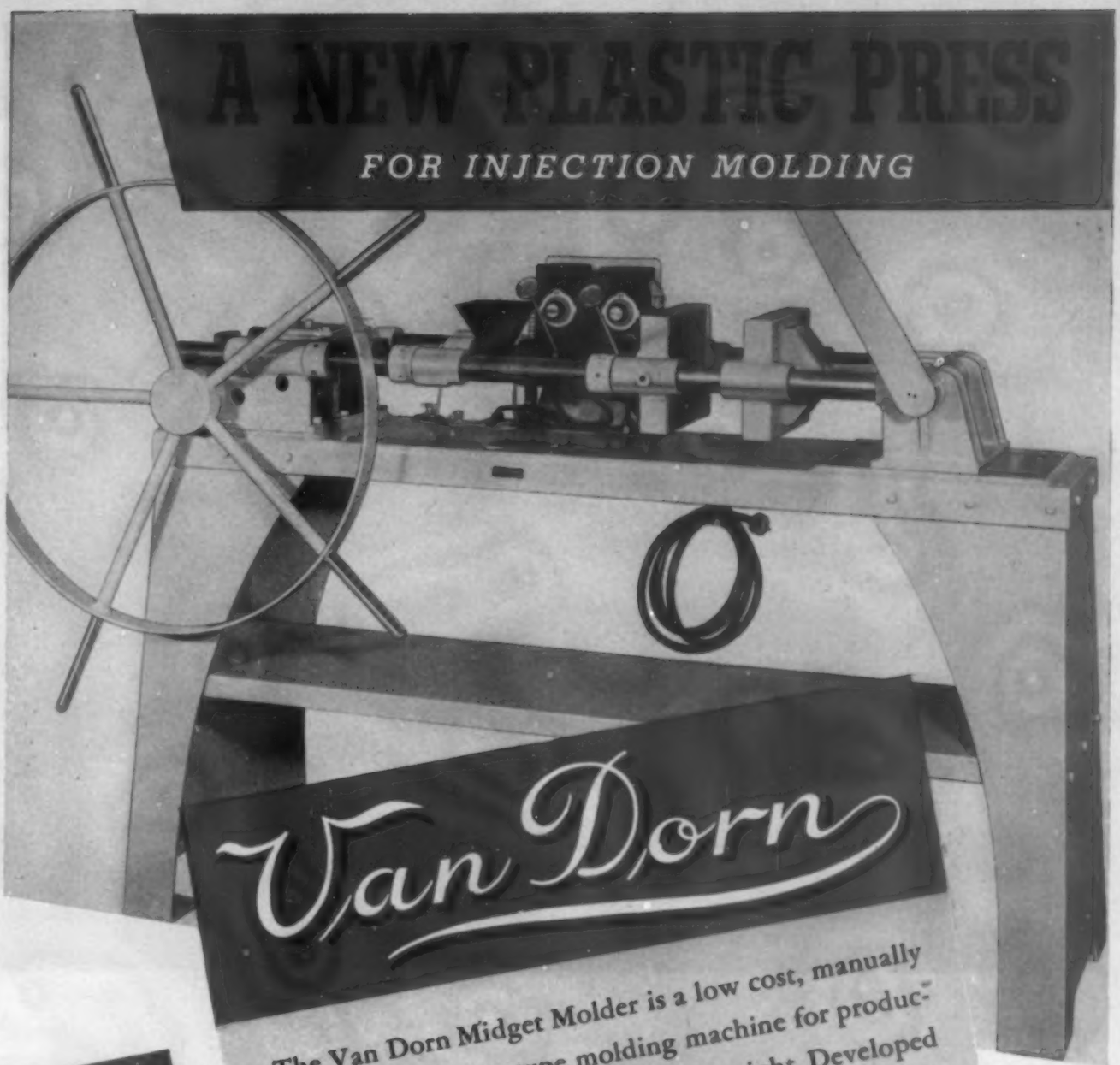

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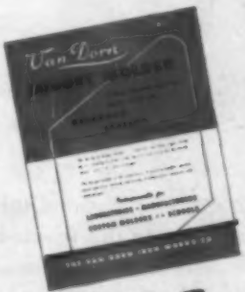

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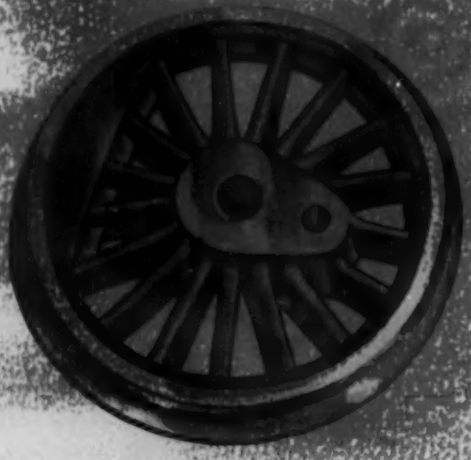

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DISSTON RESEARCH AND DEVELOPMENT
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balanced analyses have evolved to provide good hardening and suf-
ficient stiffness of core to support the case of the finished die.
Hob steels, also, have received their full share of attention, for the
are vitally important. Hob steels should have high wear resistan
and compressive strength, good machining qualities, and abil
to harden without shrinking, expanding or warping. On the fol
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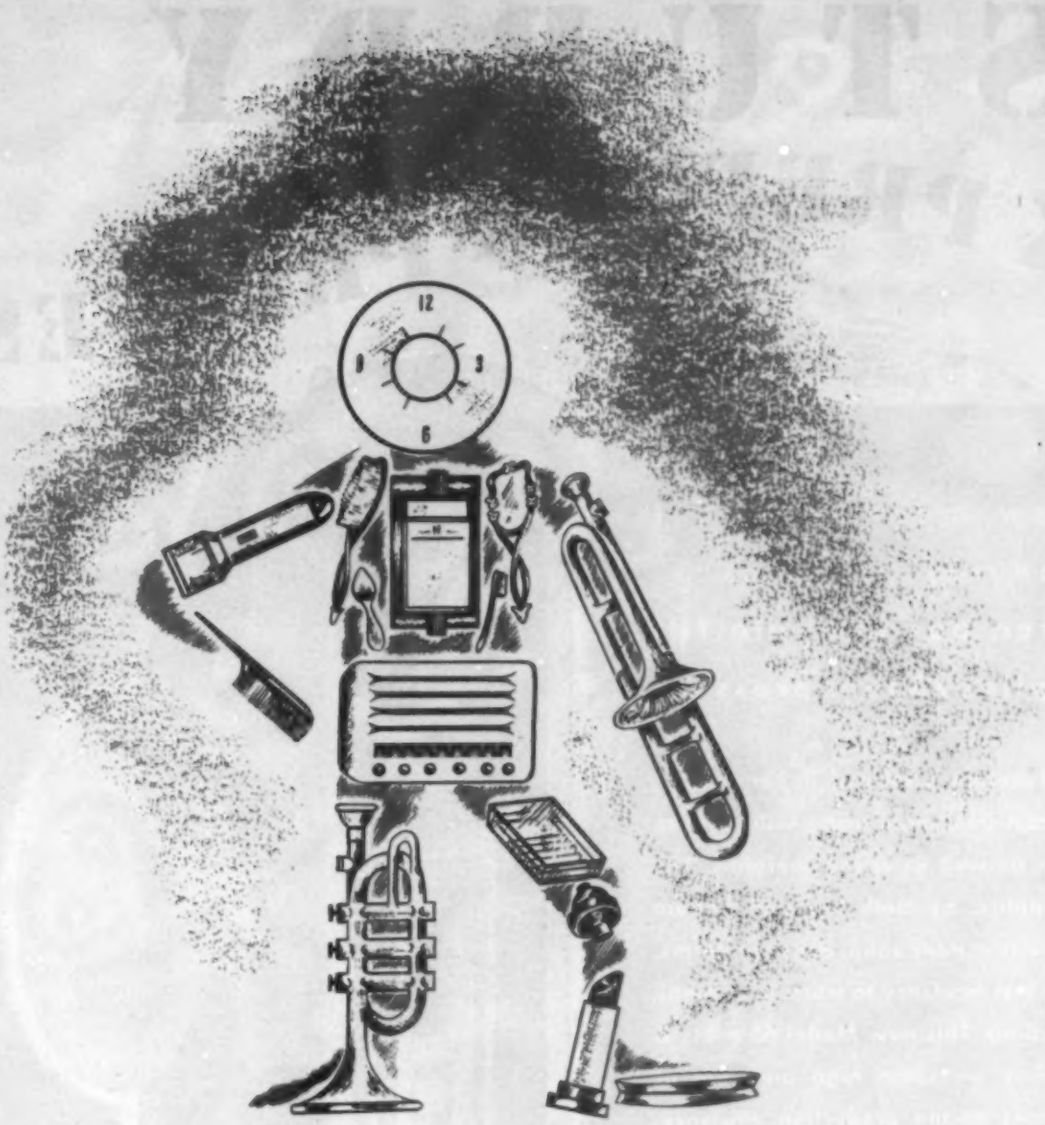

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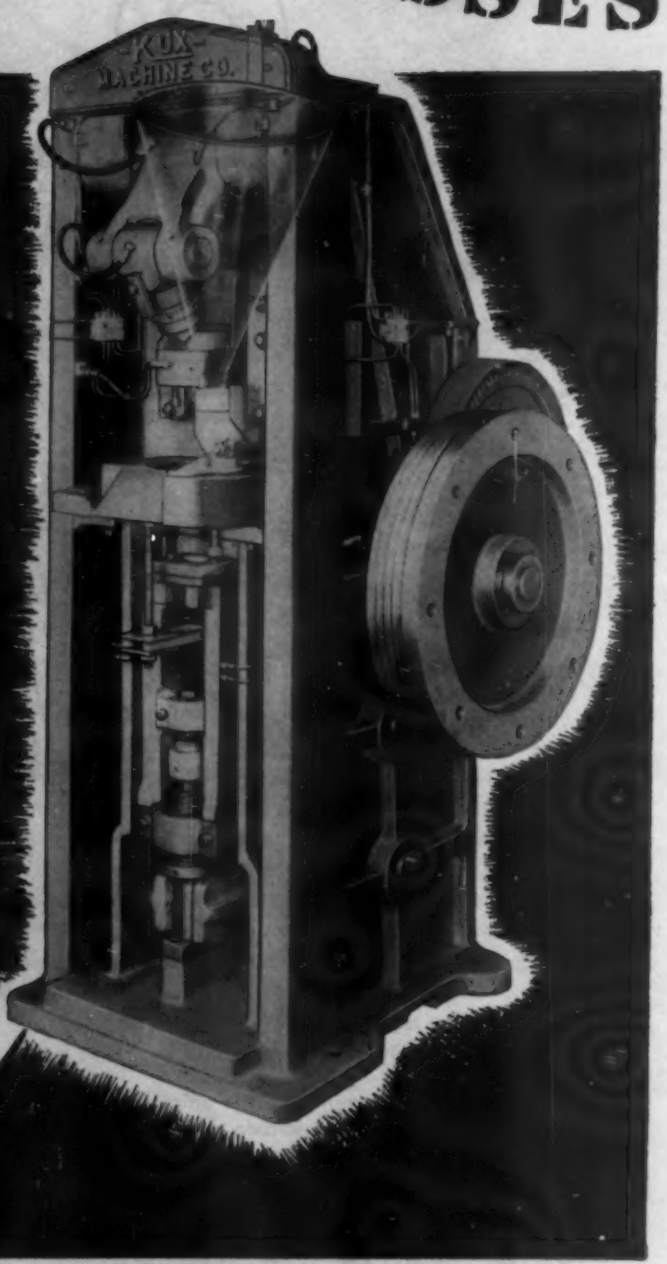

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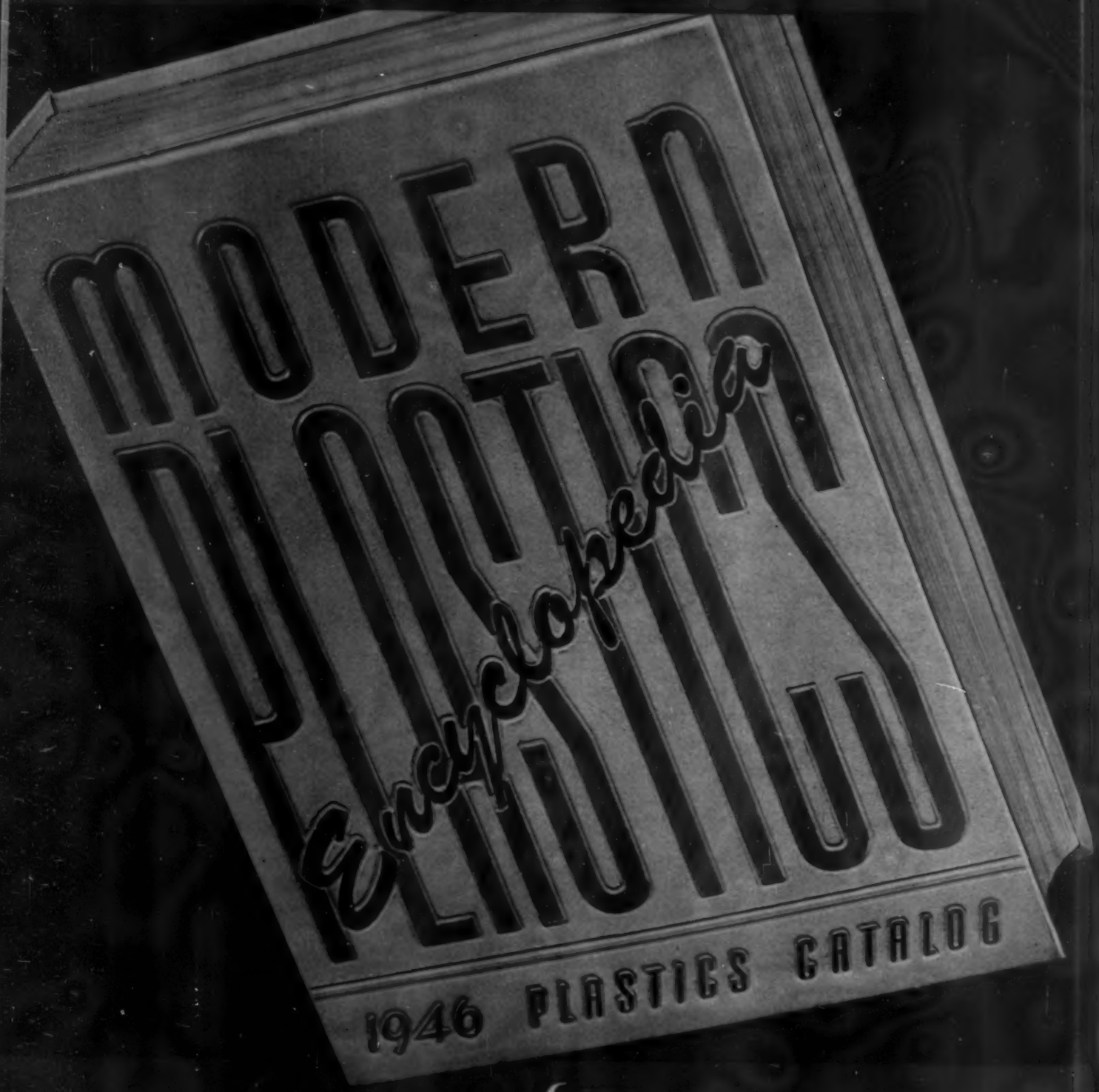

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← Photo is approximately two-thirds of actual size —Encyclopedia measures 8" x 11".

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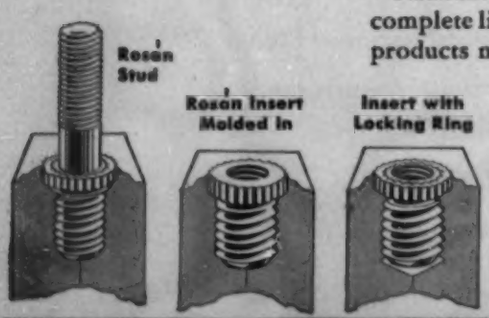

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MODERN PLASTICS
VOLUME 23 MARCH 1946 NUMBER 7

PHOTO, WORLD WIDE

New trends in LIGHTING

HISTORY, in the illumination industry, is busy repeating itself these days. New standards of comfort and efficiency in lighting are being established, new methods are being developed to produce equipment to fit these standards on a mass-production basis, and new materials plus new ways of using standard materials are being studied by illuminating engineers. Many of these materials are plastics.

Looking over the record you get the feeling that it all happened before. And it did. Several times. It happened in 1879 when Edison invented the electric incandescent lamp. It happened in 1909 when the International Candle was approved by nations as the measurement of the effect of light. It happened in 1933, when plastics came into the picture. It happened in 1938, when the fluorescent lamp was first marketed in quantity. On all these dates another step was taken in man's progress toward the development and creation of a perfect artificial light that would be equal to daylight.

To understand the present repetition of history, as far as plastics are concerned, we have to start at 1933, when Alfred Parker and C. S. Woodside of the Westinghouse Lamp Co. presented a paper on "Illumination characteristics of organic plastics" before the Illuminating Engineering Society. New ground was being broken, plastics having been used in illumination for only a short time. The paper is still standard literature in the lighting field.

These men were writing five years in advance of the introduction of the fluorescent lamp. In the article scant heed was paid to the thermoplastics because of their lack of stability when used with hot incandescent bulbs, and fault was found with the light transmission qualities of the shades and reflectors then being made from thermosetting plastics. The authors also declared that more attention should be given to the problem of heat. They proved

Here are three articles on the same subject: new developments in the use of plastics in lighting. The first gives the reader an opportunity to assess present trends toward the architectural and functional use of plastics in illumination. The second deals entirely with fluorescent lighting. The third is the story of the latest developments in railroad car lighting, which are likely to have a marked effect upon the future design of residential and industrial fixtures.

PHOTO, COURTESY CELANESE PLASTICS CORP.

Left—There is almost no limit upon the variety of shapes which can be achieved in shades for table or floor lamps using sheets of cellulose acetate

Below—Molded urea ceiling fixtures have an excellent record of service in both home and office

PHOTO, COURTESY AMERICAN CYANAMID CORP.

that the diffusing and transmitting properties of surface-etched plastics are affected by the type of surface treatment given them, but not by the thickness of the material. Cloudy plastics, on the other hand, are affected by thickness but may be given uniform optical qualities in any one thickness.

Within three years after that paper was read millions of efficient plastic lighting bowls were in use. Possibly the earliest was a Beetle reflector made for the Pullman Co. by the Richardson Company. This was followed by an automotive dome light made by Chicago Molded Products Corp. and American Insulator Corp., one of which used Plaskon.

Then the Illuminating Engineering Society's standards for reflecting bowls were set. These semi-indirect reflectors conceal the incandescent light source and direct light toward the ceiling, from which it is reflected downward, while allowing some to be diffused through the bowls. Until the war began, Bryant Electric Company, General Electric Company, Waterbury Companies, Inc., and others produced them by the thousands from urea compounds. Now they're making them by the thousands again.

The plastic lighting bowls offered several major advantages: they were light in weight, therefore less dangerous than glass in use and less expensive to ship; they could be mass-produced with precision; they were low in cost; their lighting properties were excellent.

Semi-indirect reflectors of plastic have been successfully used with bulbs up to the 1000-watt size. They are good diffusers, breaking up the light properly to make it softer, and they have good light transmission and reflecting qualities. Their maximum shrink in use is less than $^{12}/_{1000}$ in. per inch. But they required a considerable amount of designing, because the critical temperature of urea is 170° F. and for every 10° over this temperature, the life expectancy of the plastic is cut in half.

These problems were effectively solved by shaping the bowls to avoid direct heat from the bulbs, by careful attention to wall thickness and by the use of alpha-cellulose filler. As a result, these bowls soon outstripped the hand-worked glass product and were even able to compete with machine-made glass bowls when they appeared. The melamines now coming into use, with their higher (210° F.) critical temperature, widen the possible applications for plastic. When reflection only is needed, laminates can be used as well as asbestos-filled phenolic and metal-painted urea moldings.

Some of the thermoplastics have invaded the incandescent lighting field in sheet form, in laminates and as woven monofilaments for lamp shades.

But it was not until the arrival of fluorescent light sources, with their much lower heat factor, that thermoplastic materials began to develop a big position in the lighting field. The place of plastics in fluorescent lighting is described on pages 94 through 96.

Effectiveness of light piping

The peculiar ability of the acrylics to carry light around corners led to a whole new series of lighting applications. For commercial use colored acrylics, styrenes, vinyls and acetates came into being as light diffusers because of the flattering quality of light coming through the tinted plastic. In some cases clear plastic lenses centered in translucent diffusing material made it possible for store lighting to be kept soft while transmitting high-intensity light which acted to spotlight the merchandise.

Developments on the way

Even now, more developments are in the laboratory or early production stage, some the result of war research. Impression laminates of translucent material for street lighting may be expected any day. It is estimated that a city the size of Detroit will save $80,000 a year through the reduction in breakage this use of plastics will effect.

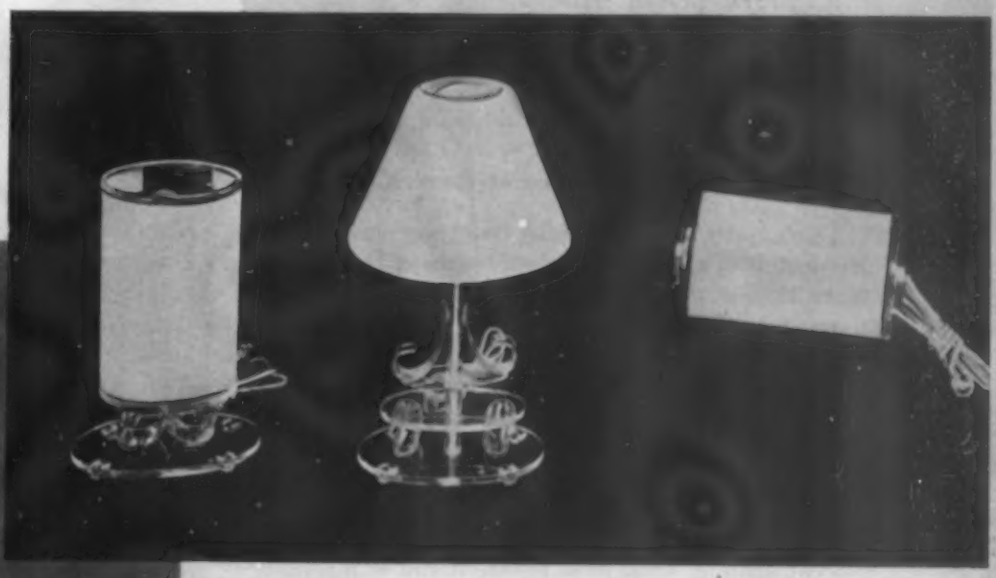
What may be done with infrared and ultra-violet is likely to prove revolutionary. Pigmented Tenite II, used as a filter for black light, is well known; now Durez is being used in a holder for ultra-violet sterilizing lamps in food plants. Worth noting is the fact that Parker and Woodside, away back in the year 1933, foresaw this possibility and charted the reaction of all the various plastic materials to ultra-violet light.

The size of the field

The lighting industry expects annual sales of 333,000,000 incandescent lamps and 10,000,000 fluorescent lamps for residential use alone by 1950. Every one of those lamps will have to be diffused and shaded.

In every case the plastics industry will be given technical assistance by the Illuminating Engineering Society whose recommendations go to the American Home Lighting Institute (which certifies installed fixtures on the basis of those recommendations) and to the Certified Lamp Manufacturers which certifies portable lamps. The new I. E. S. recommendations are now in draft form. They provide limitations for brightness exposed toward the eyes in five different zones from 33 in. to 68 in. from the floor and set up a formula for the increased diffusion needed with the stronger lights. The versatility of plastics gives promise of new shapes and textures in this diffusion material.

PHOTO, COURTESY PENNSYLVANIA HOTEL



Below—Plastic is used for the reflector in this attractive modern portable table lamp

PHOTO, COURTESY AMERICAN CYANAMID CORP.

Top—Light piping qualities of acrylics make possible the effectiveness of this entrance sign. Light from a hidden source makes red acrylic letters glow. Above—Sheets of methyl methacrylate in various weights, clear and translucent, are formed into table and bedlamp shades

PHOTO, COURTESY JOHN C. VIRDEN CO.

1—The combination of molded polystyrene end pieces and extruded polystyrene side panels can be credited with the light weight of this fixture and for the soft light that it throws out

FLUORESCENT fixtures

The growing popularity of fluorescent lighting has meant the use of more thermoplastics in fixtures

HIGH noon on a hazy day. That, according to many illumination engineers, is nature's best in lighting. Everything can be seen clearly because the haze is high; yet there is no glare to hurt the eyes, no overintensity to throw color values out of scale or to create dense shadows. Nature uses a large, high source of light and a diffusing material near that source to provide perfect lighting.

Thanks to the fluorescent lamp and to diffusers made of plastics, man is now able to rival this outdoor perfection in interior illumination. In fact, he is able to provide effects not available in nature.

A growing acceptance of fluorescence

The growth of this business has been phenomenal. Between 1938 and 1945 the sale of fluorescent lamps rose from 200,000 to 37,500,000—nearly 90 percent going for commercial and industrial use. Now a huge home market is opening up for fluorescent lighting. A survey by *McCall's* magazine showed that out of 100 average readers, 25.2 percent intended to install fluorescent lighting in their living rooms, 41.6 percent liked it and were considering it, 2.5 percent had it already and 30.7 percent didn't like it. For dining rooms the figures showed 17 percent fully sold, 37.8 percent liking fluorescent lighting, 4.6 percent having it and 40.6 percent disliking it. The size of the market is obvious and the auxiliary market for plastics is in proportion because, to quote from Morris Sanders, well-known designer, "No group of materials approaches plastics in their adaptability to fluorescent lighting requirements."

Being fairly bright, fluorescent lights must be set high or hidden. Being cool, they can be baffled, directed and diffused by plastic materials which are light in weight, easily produced in mass, essentially non-fragile and versatile enough to provide the wide variety of decorative effects in illumination which are rapidly becoming more and more necessary to modern living.

Thermoplastics in fluorescent fixtures

While thermosetting plastics, chiefly the ureas and melamines, are preferred as shields for incandescent lamps because of heat, the fluorescent field is open to thermoplastics. They must be dimensionally stable and color stable, must not deteriorate through age, must have structural strength, must remain flexible in reasonable extremes of temperature, must not readily support combustion, must be translucent and must not absorb much of the light passing through them.

Obviously, all thermoplastics do not possess all these qualities in the same degree. Yet all except cellulose nitrate are now being successfully used for fluorescent light diffusion. This is because designers and engineers have planned the fixtures to suit the materials, material makers have evolved special formulations and molders and fabricators have kept pace with both.

Where some dimensional change in a variety of moisture conditions is inevitable, the plastic is framed in light metal in which it can slide. If a material is not highly resistant to fire, its use is directed to less hazardous locations. A recent query regarding poly-

styrene for fluorescent fixtures, directed to the Underwriters Laboratories, Inc., brought up the question of the suitability of all thermoplastics for lighting fixtures. In reply the Laboratories authorized this statement:

> "The Underwriters Laboratories, Inc., have gone on record that they will accept fluorescent lamp holders made of polystyrene and have no objection to the use of this and other slow-burning plastics in diffusion material for fluorescent lamps in locations where normal operating temperatures are not such as to adversely affect the plastic material, thereby causing it to burn, deform or disintegrate."

New and established fixtures

Newest entrant in the fluorescent field is John C. Virden Company. Because of the physical size and weight of parts necessary for its new fixtures the company uses polystyrene. The fixture shown in Fig. 1 uses two 40-watt lamps and features a new technique of extruding polystyrene. The side panels are extruded from the company's private mold and the end cup design is molded of the same material, both sections being

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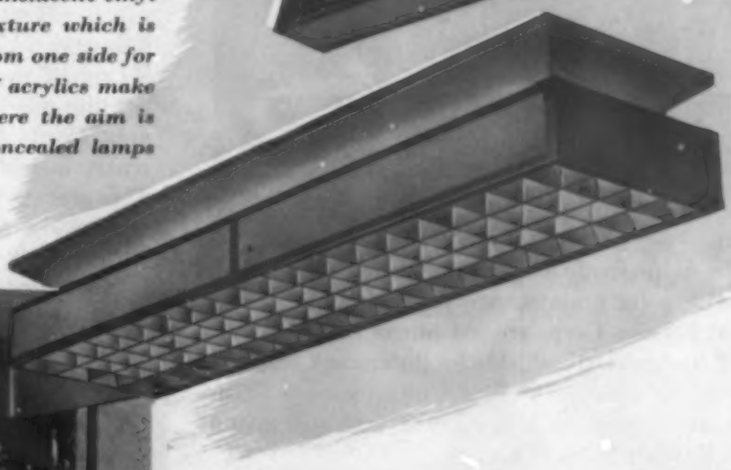

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2—Urea is the material employed in this semi-indirect commercial lighting fixture. 3—White translucent vinyl sheeting forms the side panels of this fixture which is so designed that it can be opened easily from one side for cleaning. 4—The light piping qualities of acrylics make them ideal for use as a wall covering where the aim is to achieve a soft spread of light from concealed lamps

PHOTO 1, COURTESY MOE-BRIDGES CORP.
PHOTO 3, COURTESY R. & W. WILEY, INC.
PHOTO 4, COURTESY ROHM & HAAS CO.

produced by the General Electric Company. The material resembles crystal clear glass, its form providing prismatic diffusion. It is rigid, light in weight and permanent. At the top of the metal cross louvering on each side of the fixture are hooks by which the plastic side panels are clipped into place, allowing their easy removal for maintenance.

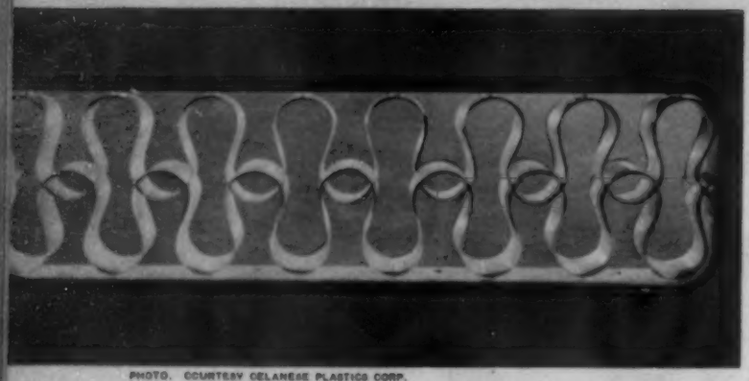
This fixture company is now experimenting with tinted polystyrene in subtle shades of amber, gold, blue and green and is working on matching finishes for the exposed metal parts of the lamp fixtures.

R. & W. Wiley, Inc., announces a couple of new fixtures in its Fleur-O-Lier line. These have side panels of white translucent Vinylite, chosen because of its dimensional stability, color quality, pliability in heat and cold, resistance to change due to moisture and age, and non-support of combustion. As Fig. 3 clearly

PHOTO, COURTESY F. T. WAKEFIELD BRASS CO.

5

5—Extruded 4-ft. strips of cellulose acetate butyrate form the sides of these fixtures which are well designed for use in series to form a continuous band of light. 6—Extruded cellulose acetate is used to good effect for the decorative louvers of this fixture



PHOTO, COURTESY CELANESE PLASTICS CORP.

6

shows, the light plastic sides make possible easy access to the fixtures for maintenance purposes.

General Plastics Corp. are old-timers in the manufacture of thermoplastic shields for fluorescent lighting, using cellulose acetate chiefly. Units up to 4 ft. in length manufactured by this company are still giving good service after years of use.

Moe-Bridges Corp. has used Vinylite sheets in its Unite-A-Light fluorescent strip fixtures and a combination of Plaskon housings and canopy with Vinylite sheets for semi-indirect commercial fixtures. The Plaskon parts are molded by Plastics Engineering Co. Beetle also has been used for reflecting shields and bracket housings.

Edwin F. Guth Co. has recently brought out a model in which molded Lustron is used in a snap-on diffuser. These accessories are offered in a variety of colors for display illumination and decorative purposes. The Miller Co. is producing a fixture which uses embossed Vuelite in semi-cylindrical sections.

Sylvania Electric Products, Inc., one of the largest companies in the field, is experimenting with molded plastics in some of its new fixtures and will use laminated acetates in varied thicknesses and pigmentations. In addition, the company has done some work with Plexiglas, using fluorescent lamps hidden behind the sheet of acrylic resin. Frank Mansfield, director of sales research for this company expects a sale of 3,500,000 fluorescent fixtures for residential use alone by 1950. The firm has some hope of overcoming electrostatic attraction of dust by plastics, a factor which affects the maintenance of light intensity in industrial locations.

One of the earliest uses of plastics in fluorescent lighting was in Louverplas, made by the Doane Products Corp. from Plastacele. The material is currently in wide use and in course of new promotion. This acetate product is a lamination of sheets of clear and colored acetate, sliced to make a thin plastic sheet with built-in louvers of white, black or pink. It can be either polished or given a prismatic ribbed surface and is commonly used for the control of glare. The same company has patented the Tandelamp in which the lamps are positioned in the axial plane instead of laterally. This is said to make better use of light.

The F. W. Wakefield Brass Co. produces a fixture in which extruded acetate butyrate is the diffusing material. The Grenadier fixture made by this company uses Tenite II, supplied in extruded 48 1/4-in. length strips by Sandee Mfg. Co.

Mass production of low-cost units

Fluorescent fixture manufacturers face huge market increases where mass production of low-cost units will be the key to success. That is why plastics loom so big in their plans.

Experimental work is under way on applications of translucent contact laminations, larger and longer extrusions, architectural panels for whole ceiling diffusion, black light filters of cellulose acetate butyrate to reflect luminous pigments from carpets, drapes and exit signs in theatres. Bigger fixtures for commercial use are planned. This will mean increasing necessity for decreasing weight—a bigger market for plastics!

Railroad car LIGHTING

Lamp designs now being perfected for railroad use will influence future home and industrial fixtures

IT is the nature of humans to want to travel in luxury. For that reason railroad cars are designed to provide the latest in comfort and convenience. Among the elements contributing to this luxury is diffused lighting.

Safety Car Heating and Lighting Co. has used plastics in lighting fixtures for many years. So it is no surprise to find the company's first postwar cars lighted exclusively through plastic shades. Plexiglas in white translucent formed sheets and extrusions is the material; fluorescent lamps are the light source.[1]

Aside from the normal requirements for good diffusion, this plastic was chosen because: 1) it has great dimensional stability, expanding or contracting less than $^1/_{32}$ in. in a 3 ft. length for every 15° F. change in temperature; 2) it is strong enough to bear the weight of baggage in overhead racks (Figs. 3 and 4); 3) its life is as long as that of the car; 4) it is flexible enough in thinner gages to be snapped into position in fixtures; 5) it has excellent light transmission qualities (82 percent in 0.060 in. thickness); 6) it is able to stand vibration.

[1] The special acrylic sheet is sold as "Safety 68" by Safety Car Heating and Lighting Co.

BETTER LIGHTING WITH PLASTICS

Having proved the material's serviceability in prewar installations, L. Schepmoes, manager of the company's lighting fixture department, proceeded to design the latest fixtures in such a way that shadows are eliminated, illumination is good, maintenance economical.

Possibly the most outstanding piece of designing was done for the ladies' powder rooms, the bedrooms and wherever mirrors are used. Ceiling fixtures around three sides of the small rooms are used against light-colored, but not glossy, wall finishes. The result is plenty of light on the face, but little in the eyes, because the fixtures are concealed by the mirrors. The superiority of this design can be judged from the fact that it provides 20 foot-candles of light on the face, 11 in the eyes and 8 under the chin. The intensity is uniform all over the mirror. Similar pleasing and efficient lighting is obtained from several modifications of this design, such as a large ceiling light with plastic shade.

An experimental Plexiglas basin is another feature of the powder room, serving not only as a wash basin but as a diffuser for a fluorescent Circline lamp placed under it. A

1—The trend in railroad lighting is toward the elimination of shadows. In this mock-up for a ladies' powder room the ceiling fixtures are so positioned that there is plenty of light on the face, very little in the eyes

ALL PHOTOS, COURTESY SAFETY CAR HEATING AND LIGHTING CO

2—In another experiment in railroad lighting, an acrylic wash basin is made to serve as a light diffuser for a circular fluorescent lamp which is positioned immediately beneath the white or faintly colored bowl

3

4

similar basin at the Rohm & Haas Co. laboratory has stood up under 7½ months of constant use with water at below 140° F. The top surface of the basin is abraded in advance so scratches will not show; the under surface may be tinted to give color to the light.

The day coach now being introduced has a single wide channel of fluorescent light running along the center of the ceiling. The base of each connecting fixture in the chain is made with a small flange into which the formed plastic diffusion panel snaps.[2] Then a narrow strip of the same plastic snaps over the joint between two such panels, rendering all the metal parts invisible and producing a tube of light which is of uniform brightness the full length of the car.

At either side of these coaches are baggage racks made of heavy-gage translucent acrylic set in metal frames. This material is made with deep corrugations to give it additional strength. Over every seat two of the corrugations give forth light at the pressure of a conveniently located switch.

A mock-up of the new dining car shows continuous fluorescent ceiling lighting or continuous side-wall lights. Clear acrylic sheet came in for a new task in the dining car. Tables are T-shaped, the leg of the T being cut off from the head by two panels made up of laminations of the plastic, engraved and edge-lighted in color. Each plastic sheet in the lamination carries a different part of the three-dimensional picture and is edge-lighted in a different color. With this table set-up, a party of two can eat at the leg of the T while three may be accommodated at the head—both enjoying privacy, good lighting and fine food.

The economy obtained through the new fixtures is evidenced by the fact that eight of the now obsolete incandescent fixtures provided only 3000 lumens for 200 watts used whereas a single new fluorescent "Safety 68" fixture using 136 watts gives 5600 lumens.

Don't be surprised when adaptations of these designs arrive in the hotel and residential field. Railroad cars offer accelerated pioneering in new methods and the use of new materials. They offer introductory proof of the durability and utility of plastic materials in modern lighting.

[2] A patented development of the Safety Car Heating and Lighting Co., Inc.

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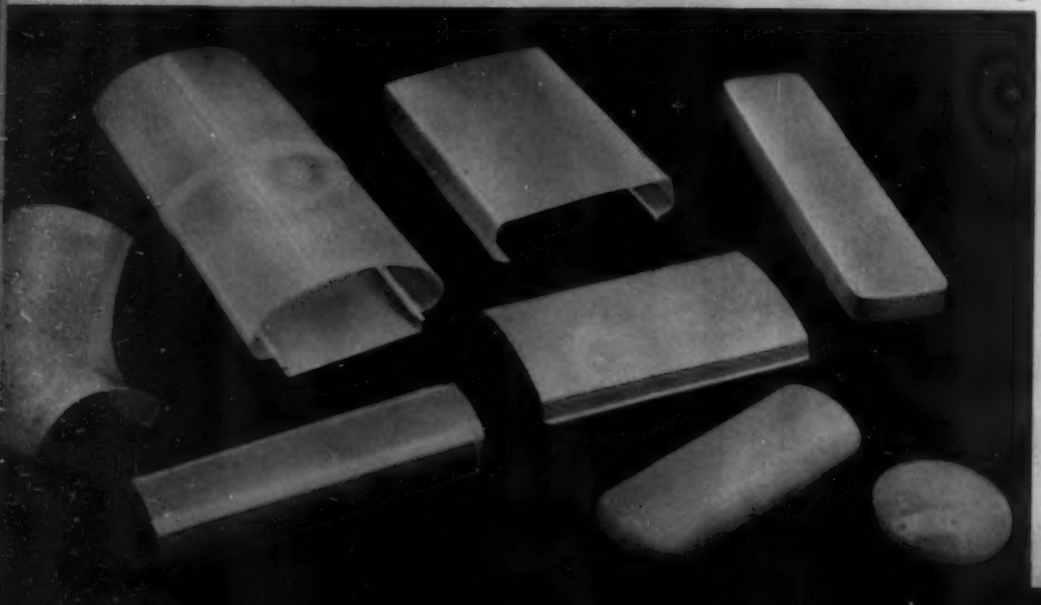
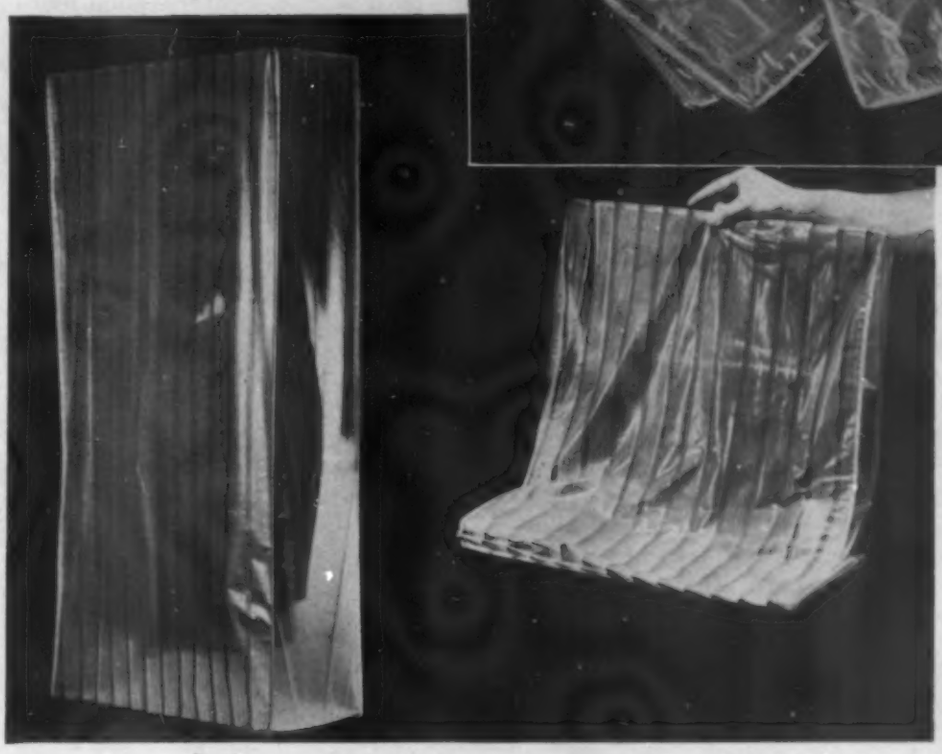


3 and 4—One user of acrylics in railcars envisions their use as combination baggage racks and lighting fixtures. Here the design is shown lighted and unlighted. 5—One of the advantages of plastics as lighting fixtures is the ease with which they can be formed into a variety of shapes

Protective vinyl covers



The housewife can now purchase vinyl drawer cases and closet accessories in a wide variety of shapes and colors

Vinyl garment bags, that come in short lengths for suits and long for dresses, are transparent on the zipper side so clothes may be identified quickly. The edges of all the pieces are triple folded and sewn to give strength to seams

ONE of the outstanding examples of the beneficial impact of plastics on the American standard of living has been the development of waterproof, fadeless shower curtains and closet accessories.

Now, Plastron, Inc., affiliate of Arnel Co., Inc., has created a line of closet accessories which a housewife may buy a piece at a time and be assured of a perfect match when she adds to her set at a later date. Or she may buy a whole 8-piece ensemble at one time. In either case, she will find no variation in quality, styling and color among pieces.

Three main problems faced the company in the creation of these products: *first*, the drape of the goods had to be soft and natural; *second*, the bags had to be beautiful in the modern manner, with pastel coloring in flat tones; *third*, the material had to be semi-translucent yet transparent enough so that the user could recognize a garment without opening the bag.

The *first* problem was overcome by the use of Plastron, a polyvinyl chloride film specially created for the Arnel Company. It was formulated to shades of pale green and blue, royal, peach, orchid, maize and rose; and surfaced to take printing at a rapid rate. The *second* problem was met by the use of a special printing process in which the ink is so firmly applied to the film that it will take accelerated abrasion and bending tests far in excess of any punishment the product will meet in use. The answer to the *third* problem lay in the use of the clear Plastron on one side of each accessory bag and printed film for the other panels.

Printing of the film is done by the Velveray Corp. with specially formulated inks. Stitching of the film is now done by threaded machines, since to date the makers have not been able to secure an electronic solvent sewing machine that will handle corners and multilaps to their satisfaction.

DEEP DRAWN Laminates

The first civilian application of a new process which uses high pressure equipment but differs from both low and high pressure

HIGH pressure, low pressure and contact laminating are three more or less separate and standardized methods of producing molded parts. As its name suggests, *high pressure laminating* is made possible through the use of one-half ton or more of molding pressure per square inch, heat, resins of the type that lend themselves to this pressure and method of cure, and a filler such as duck, paper or glass cloth. By this process, flat sheets, tubes or rods are produced which possess very high strengths, satisfactory water absorption and dielectric properties commensurate with the filler.

Carrying this high pressure process one step further, shaped parts, within limits, can also be produced. However, due to the high pressure necessary in the process, tools must be manufactured from hardened steel and are, therefore, comparatively expensive.

Low pressure and *contact laminating* are rather new comers in the field of plastics. They were first developed during the war to provide a means of producing large and intricately shaped parts. These parts, generally for aircraft, were needed in relatively small quantities. Consequently, it was uneconomical and many times impossible to produce them by high pressure molding. Because low pressure laminators make their molds from such things as cast aluminum, cast bronze, wood, plaster and, in some cases, concrete rather than steel they enjoy an initial cost advantage over high-pressure molders and can afford to undertake the manufacture of short run parts.

Basically, these low pressure molded laminates are a hybrid product. They differ from the traditional high pressure laminates and parts produced from molding powder, but possess characteristics of both. Many plants were set up throughout the United States for the production of parts by this low pressure process, and through their work the American war effort was speeded up considerably. Domes for radar equipment probably constituted the bulk of the production by this method with air scoops; droppable gasoline tanks, depth bombs and similar pieces making up a large part of the balance.

With the advent of V-E Day these low pressure plants were handed what amounted to almost a 100 percent cancellation of orders. The result? A number of the plants simply closed their doors, others sold out, leaving only the larger plants.

The immediate problem for all these companies was to find new products which could be produced satisfactorily by this method of molding and at a price competitive with other methods such as metal stamping. To persons versed in problems of low pressure molding, that is, in costs of fillers and resins as well as the methods of production, it was immediately apparent that unless the properties of the part molded from low pressure made it physically better than one stamped from steel or aluminum, it could not possibly compete with a metal part. On price alone the low pressure piece was not in the race.

High pressures necessary

The Andover Kent Co. gave this entire matter a great deal of thought and decided that it would eventually terminate its production in the low pressure and contact laminating field. Its executives hit upon a process and method of production which, in their opinion, was not competitive in any sense with other low pressure, contact, or high pressure laminating processes. Neither did it conflict in any manner with

1—*The flash on the outside bottom shell of the ice saver is quickly cut away by a high-speed rubber cut-off wheel*

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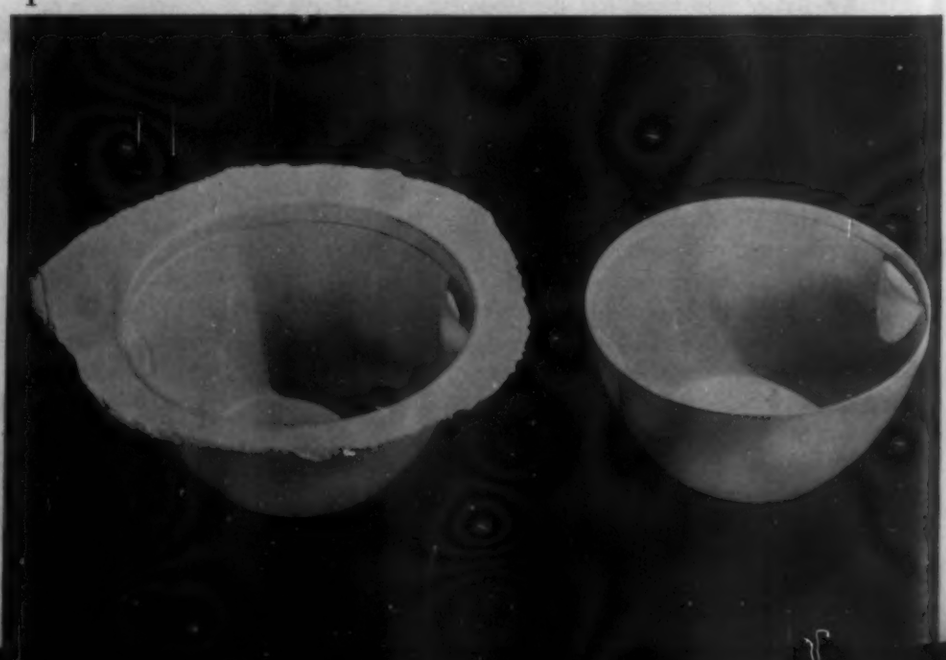

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2—The deep drawn laminated ice saver has many advantages over its metal counterpart. It is less fragile, more colorful, far easier to insulate

3—Three deep drawn laminates comprise this unit, supplemented by a quantity of insulating material inserted between inner and outer shells. An advantage of plastics in these parts is that handles can be the molded in

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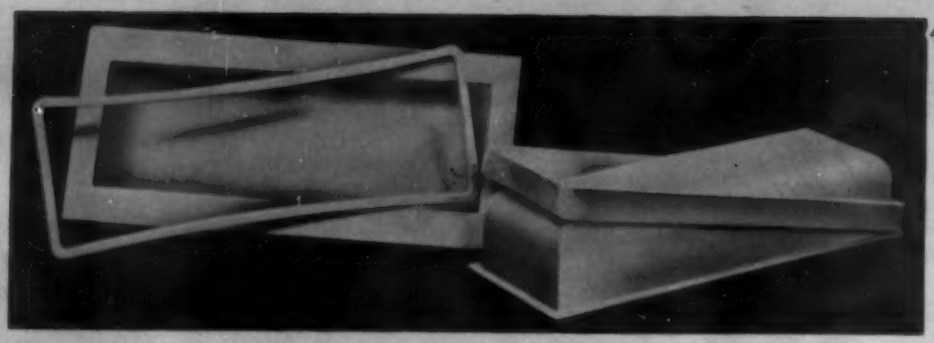

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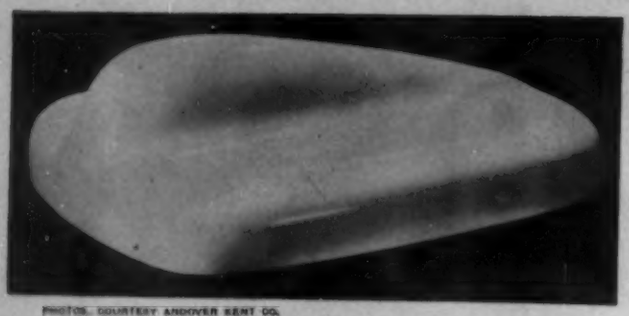

5

PHOTOS, COURTESY ANDOVER KENT CO.

4 and 5—This new process is adaptable to a wide range of forms. These shapes are but a few of those that have been tried out thus far

the compression molding of powder materials or the injection molding of thermoplastics. They christened this new process "deep drawn laminating." It bears no resemblance, however, in either material or method of production to the process known as postforming. The details of this new process are being held confidential until the patent applications have been processed in Washington. At that time, MODERN PLASTICS will be privileged to carry a detailed account of the method. Now, it is only possible to state that high pressure hydraulic press equipment is used. By this process, the company is able to produce deep draws with very thin sections, in many instances as low as 0.020 in. in thickness. Furthermore, the parts can be held to very close tolerances, in some cases ±0.001 on a wall section of 0.070 inch. It is also possible to hold very close tolerances on outside dimensions.

There are many reasons why the company is taking this step. During the war, it had many requests for shaped laminates. Company technicians knew that high pressure laminating had certain limitations, both of product and process, for this sort of production. As for bag molding and contact laminating, production cost put these parts out of the running in many applications where price is the most important factor. This, they felt, left a large territory for this new process.

The first product—an ice saver bucket

Having made the decision to change their method of production, Andover Kent looked around for a good postwar application and came up with the idea of an ice saver bucket. It was necessary that the material of construction provide a good thermal insulation factor and have, at the same time, high impact strength. If both factors could be met, the company executives felt sure they could turn out by this new process an ice bucket which would be superior to the very fragile vacuum glass-lined buckets on the market at the time.

In considering ice buckets of similar construction produced from metal stampings, the company found them to have a number of limitations. To thermally insulate the inside ice container from the outer metal shell, an insulating breaker strip must be employed to control the thermal loss between the inner and outer shells. Due to the limitations in metal stamping, the handle for the cover would, in all probability, have to be made separately, and then the metal itself is very susceptible to denting if dropped. Of course, if the unit were lined with a porcelain insulating bowl, it would be that much more fragile. Another limitation of metal as compared to the new deep drawn laminated ice buckets relates to color. The color of the laminate is unlimited in range and it will not chip off as will paint from a metal part. In order to obtain this color, the filler used in these new ice buckets is dyed—the resin being colored to match.

Molding and assemblying

The entire unit is made up of three parts—the outer shell and inner shell for the bottom, and a one-piece cover with an integrally molded handle. The deep-drawing possibilities of this process as well as the sharp corners obtainable are clearly shown in Figs. 4 and 5.

Figure 1 shows the outside bottom shell of one of these ice savers just as it comes from the mold. The excess flash is quickly cut away from the part by means of a high-speed rubber cut-off wheel. A stream of water is used as a coolant during this operation. As a matter of fact, this flash cut-off method is used on all parts.

Before the assembly of the inner and outer shells of this bucket, the resin surface is broken at two sections on the periphery of these parts to facilitate their being glued together. Rockwool is used to line the outer shell after which the inner shell is put in place and the two halves glued together with Penacolite, a cold set resin. In order to produce a satisfactory and permanent glue joint, the outer shell is so designed that it becomes a stretch fit over the mating portion of the inner shell.

The manufacturer selling this new ice saver did not rest content with knowing that he had a good plastics application. He made immediate plans to pass on this information to the public. So, today, in every one of these ice savers is enclosed a 4-page booklet that points out the unique points about this particular unit. And, in two important respects, in strength and color, plastics are given full credit.

Fear of cyanide gas

Scientist quashes theory that heated melamine gives off cyanide in dangerous quantities

AN idea that melamine plastics would give off hydrogen cyanide gas in dangerous concentration when heated was exposed as a false thesis by Dr. Foster D. Snell in a demonstration before the Massachusetts Fire Chiefs Club last January 16th in Boston.

Dr. Snell's demonstration was designed to eliminate fear of melamine on the part of fire-fighters who had been misled by incomplete reports of an experiment conducted at a state university several months ago. This scare story grew out of a demonstration purporting to show that white rats were killed in 30 sec. by hydrogen cyanide gas given off by a 5-gram piece of melamine plastic laminate when it was heated.

Reporters were called in. As a result, the local citizenry were regaled with a lurid story in which rats were supposedly killed in an atmosphere containing one part of cyanide gas to 1,000,000 parts of air. The newspapers stated further that housewives reported to have dropped dead from heart trouble may actually have suffered from cyanide poisoning caused by fumes from a heated plastic spoon or dish. They pointed out the widespread use of plastics, the possible danger therefrom and reported that legislation would be sought both nationally and locally to regulate the industry. They contended that even manufacturers of the plastic involved were probably unaware of the danger.

Roger Babson contributed his bit in his January 14th report on stock averages by calling attention to what he called "a new plastic resin . . . which generates deadly cyanide gas when heated" and suggested national regulatory legislation.

Firemen in various parts of the country became alarmed over the possibility of dangers derived from burning plastics and their trade paper, *Fire Engineering*, in their lead editorial asked for a law to control the use of plastics.

An independent firm of consulting chemists headed by Dr. Foster D. Snell of Brooklyn was chosen to examine the circumstances and produce an unbiased report.

Appearing before the fire chiefs' meeting in Boston, Dr. Snell conducted elaborate experiments on the stage where he forcefully indicated that the white rats killed in the Nashua demonstration probably died from carbon monoxide poisoning; that we have been breathing cyanide gas in small quantities since the beginning of history; that almost any nitrogenous item such as wool, felt, beefsteak, leather, etc., gives off small quantities of cyanide gas when heated; that melamine plastics would *not* burn of themselves.

Since then, Roger Babson has admitted his information came solely from the University scientists. These officials have stated they were misquoted, that it was largely a question of how much cyanide gas would be passed off and that they would do nothing more about it.

The magazine, *Fire Engineering*, after making its own investigation, said that, "until all the facts are forthcoming we suggest that neither the fire service nor manufacturers lose any further sleep over the matter."

At the meeting in Boston, Dr. Snell said that the average householder would be astounded to know that such common substances as newsprint, steak, milk, clothing, wood, produce toxic gases if burned under certain conditions. But, he continued, that doesn't mean their use should be discontinued.

The facts about cyanide, he said, are that if you try to poison an animal with it, you have to use a tremendous amount. To kill rats and roaches it is customary to use about 1000 parts per 1,000,000 of air. In a fire where there is sufficient air to support combustion, the cyanide will be diluted to an extent that it is not lethal to man, and the same air currents that carry away the smoke of the fire will disperse the gases.

In his experiments before the firemen Dr. Snell killed a rat by exposing it to gases which had been produced from a crucible containing melamine plastic which had been heated to a temperature of 1500° F. But he then killed another rat the same way by burning a newspaper. Fumes from the newspaper combustion contained no cyanide gas because newsprint is pure cellulose and contains no nitrogenous material. Both rats were killed by carbon monoxide; autopsies of the rats were not held at the meeting but the same experiment has been conducted many times and autopsies showed an 80 percent saturation of carbon monoxide in the animals' blood stream.

Another rat was exposed to an atmosphere of 100 parts of cyanide per 1,000,000 of air for 30 min. and is alive to this day unless he has succumbed to an accident. This rat suffered less inconvenience than another which was exposed to burning wool under the same circumstances.

In explaining these experiments, Dr. Snell said that 5 grams of melamine glass laminate gives about 50 parts of cyanide per 1,000,000 of air to the gas chamber when heated by a gas burner or 90 parts if heated by an electric burner. In contrast, 5 grams of wool over the electric heater gives 135 parts of cyanide per 1,000,000 of atmosphere.

Dr. Snell emphasized that the new things, such as plastics and solvents, which seem to have alarmed firemen are, in many cases, less of a fire hazard than the more familiar products they supersede.

New plastics parts

ALL PHOTOS, COURTESY ADMIRAL CORP.

Radios were first. Now refrigerators, and vacuum cleaners described elsewhere in this issue, are coming on the market with more, with new, plastics applications. Polystyrene, phenolic, acrylic and phenolic impregnated paper are featured materials in these refrigerators. Other uses of plastics are promised for the future

boost refrigerator efficiency

IN BRINGING out their three major lines of postwar refrigerators, Admiral Corp. has turned to plastics again and again as the material from which to fashion the newer features. Some of the plastic applications are found in all three models. Others are incorporated in but one or two lines.

Basic parts common to all models

The largest single plastic piece, a standard part on all the new refrigerators, is the inner door pan molded of Capac, a laminated paper impregnated with phenol formaldehyde. This material was adopted because it provides good thermal insulation, yet is economical. In the Dual-Temp refrigerator which features two separate compartments—one maintaining a freezing temperature, the other a more moderate temperature for ordinary preserving of food—a flat seal surface is provided across the inner door to assure good fit.

The breaker frame, another basic unit of construction, is molded in one piece in a chromium-plated mold which produces a very smooth finish all ready for painting. It replaces the four breaker strips (joined to form a rectangle) used prior to the war in the same application. Like the door pan this part is produced by the Capac Mfg. Co., being finished with blue enamel. Held to the cabinet by bosses, it is sealed with an extruded aluminum strip which fits over the plastic. On the Dual-Temp refrigerator a larger and more complex breaker piece is required so that the two compartments may be framed with a single piece. The frame has an outer edge which dips down, forming a groove which fits into the cabinet shell.

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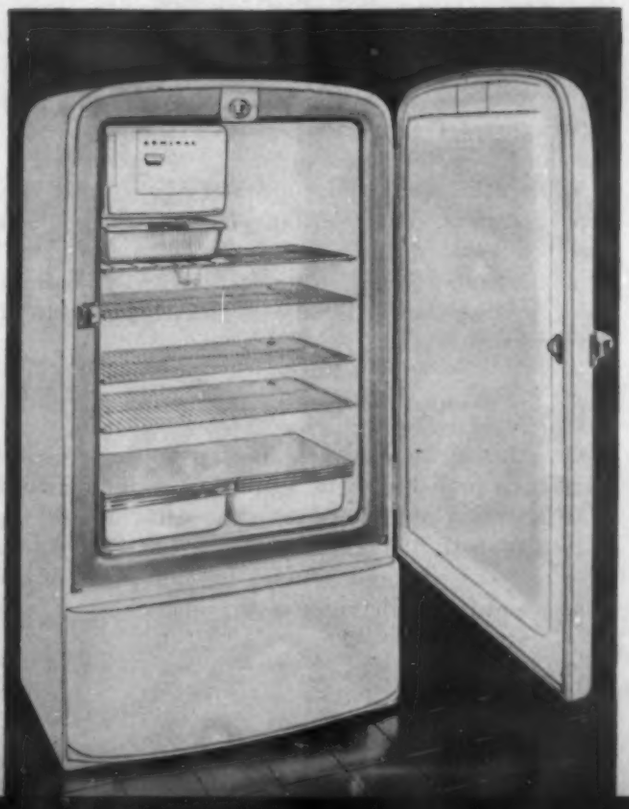


The cold-control escutcheon and cold-control knobs are injection molded of Styron, Lustron or Bakelite polystyrene, the materials used for all polystyrene applications on the three lines. These two parts are white and are molded by Superior Plastic Co. for the Master and De Luxe models and by Standard Products Co. for the third model.

From here on it may be well to take up each line of refrigerators separately, as each incorporates certain features that the others do not.

Parts in which the models differ

The *Master* is the conventional type of refrigerator and the least elaborate of the three. The only plastic feature which it carries, other than those already mentioned, is the evaporator door on the ice cube unit which Standard Products Co. injection molds of polystyrene. This material is proving to be a favorite for refrigerator use by virtue of its lack of odor and taste, dimensional stability and moisture resistance.

In the *De Luxe* the design is somewhat different. Here the polystyrene evaporator door, also molded by Standard Products Co., is a much larger piece extending across the width of the refrigerator and working on a drop-type hinge. The fronts of the hydrator unit for fruit and vegetables are designed much like the door of the evaporator and are injection molded of polystyrene by the same company. There is also a storage tray beneath the evaporator unit which is composed of two pieces of compression-molded laminated paper. This part is insulated with a $^1/_2$-in. blanket of mineral wool and sealed along the edge in a high-pressure molding press. The frame which supports the lower evaporator plate is molded of Consoweld, Resin X-Crepe paper or Capac by Molded Products Co.

The more involved *Dual-Temp* refrigerator, besides being divided into two separate compartments, has a number of features not found on the other models. For instance, the freezing unit on this model is completely separate and has transparent doors of polystyrene molded by Chicago Molded Products Corp. and a handle of Bakelite plated with metal. Studs for shelves are polystyrene, as are the hydrator fronts.

Nameplates and trim on the faces of the De Luxe and Dual-Temp cabinets are made by Hoosier Cardinal Corp. of either Lucite or Plexiglas. Similar parts will be used on all models in the near future.

1—A feature of the Dual-Temp model is a 2-section breaker frame molded of phenol impregnated laminated paper. 2—Peculiar to the De Luxe unit is a storage tray molded of laminated paper. 3—The Master, like other models, has a polystyrene evaporator door

Light weight a must in aircraft

PHOTO, COURTESY UNITED AIR LINES

THE relative weight of materials is a prime consideration to engineers and designers planning the construction and outfitting of new airplane models or the conversion of military planes to civilian uses. Every excess pound means either a reduction in the pay load or in the speed of the plane. Little wonder, then, that plastics are to be found in more and more parts and fixtures in the ships now being routed over our many airways. Their light weight insures their consideration for a wide variety of applications aboard both the new and reconverted models.

The experience, and the future plans, of the United Air Lines in equipping Douglas DC-3's and C-54's taken over from the Army for use as cargo and passenger planes may be indicative of the role of plastics aloft during the next few years and of the use that this line will make of them when its new Douglas ships have been delivered.

Acrylic windows

Stemming almost directly from the gun turrets and domes, which were hallmarks for almost all types of military aircraft, are $^1/_8$ in. Plexiglas panes for cabin windows which this company is trying out in eight of its Cargoliners and in two passenger-cargo Mainliners. According to W. C. Mentzer, United's chief engineer, these installations were made solely in the interest of weight saving since they cut approximately 19 lb. from each plane. However, the flexible nature of the plastic sheet has been found to reduce the possibilities of breakage. And indications are that from the standpoint of appearance and maintenance the acrylic will prove satisfactory. Thus far, the plastic cabin windows have remained shiny and transparent.

While other commercial operators have tried this type of window, United Air Lines felt that the problems involved justified the most comprehensive research. It was thus that its own investigations and laboratory work, looking toward the use of greater quantities of plastics, were begun.

Sound-deadening insulation

Once inside these planes, the largest single use of plastics is probably to be found in the resin-bonded glass fiber employed to decrease the sound level in the cabins of both the Mainliners and the Cargoliners. The material is placed between the outer skin of the planes and the fabric lining of the cabins where Kapok

formerly was used. Besides deadening sound, this resin-bonded Fiberglas has certain thermal insulation qualities. And, because of its light weight, it cuts the weight of a plane by 50 to 70 lb. as compared with insulating materials formerly employed by the airline for this type of application.

A flexible refrigerator

A variation of this plastic application is the vinyl coated glass cloth package refrigerator being tried out in the Cargoliners for the transportation of perishables. The special dry ice container resembles a zippered bag and has a capacity of 120 cubic feet. Measuring approximately 75 in. in width, 40 in. in depth and 75 in. in height, it is so constructed that the dry ice can be slipped into five pockets in the top. Lest the container shift position during flight, it is fastened to rings in the ceiling of the plane.

Silvery in appearance because aluminum is dispersed in the vinyl coating applied to the Fiberglas, both the inner and outer walls of the container are approximately 1 in. thick. Between these two coated sheets is the glass fiber insulation material which weighs but 10 oz. per cu. ft. despite its $^1/_2$ in. thickness. Of itself an interesting and useful application of plastics, this refrigerator presages the development of all types of new food boxes.

Cabin and cargo walls

In converting the Douglas C-54 type planes to civilian use, this airline company is trying out many of the plastic materials it hopes to use in its new equipment. For example, a vinyl-coated fabric was selected for the airplane cabin wainscoting. This same material holds possibilities as a door covering material, as a cover for the lower surface of parcel racks and as a finish for the walls and ceiling in the lounge rooms planned for the new Douglas DC-6 planes. Considering the punishment inflicted on the back of airplane seats by restless feet, this vinyl-coated fabric has been suggested for the scuff plates.

The special advantage of this type of cover material is that it is easily washed and disinfected, is light in weight, tough and pliable. Another inducement to its further use, according to Zay Smith, assistant director of design, building and airports, is its range of colors.

The cockpit and cargo areas of the planes will be stripped of their wartime gear and finished with a considerable amount of plastics. Take, for example, the Fabricoid lining of the cockpit. Serious consideration is being given to the use of resin-bonded Fiberglas laminates for cargo pit walls and to Consoweld, a phenolic impregnated paper and wood laminate, for the cargo compartment flooring.

Interior lighting and accessory fixtures

Many of the plastics applications discussed thus far may escape the notice of the average passenger, but there will be others throughout the interior of both the new and reconverted planes that will be more obvious to the casual observer.

Take, for example, the lighting fixtures. Present plans call for the continued use of acrylic shields which not only are light of themselves but make possible the use of lighter frames than are practicable when glass fixtures are employed.

Just what form these fixtures will take is still subject to further consideration but, at the moment, it looks as though low candle power incandescent lights will be employed not only for the continuous semi-indirect cabin ceiling lights but also for the illumination of the men's and women's lounges and the cockpit.

Plastic dishes and trays have many obvious advantages for use in airplanes. Again weight was an important factor in the adoption of plastics, these dishes being much lighter than china tableware. And the cups, plates and trays withstand the knocks and bumps, that sometimes attend service in the skies, better than do similar pieces made of china or glass. The use of melamine for this type of application is well established due to the material's lack of odor and to the fact that it will not affect the taste of the food it holds. It is possible that at some future date, as a result of experiments being carried on by both the United Air Lines and various materials' manufacturers, some other plastic material may be found suitable for this use. Of course, salt and pepper shakers molded of Tenite already have proved their worth in service.

Among the other plastic applications already familiar to airplane passengers are acrylic clothes hangers and transparent cellulose acetate sheets which are used to cover the emergency exit handles.

Plastic plumbing

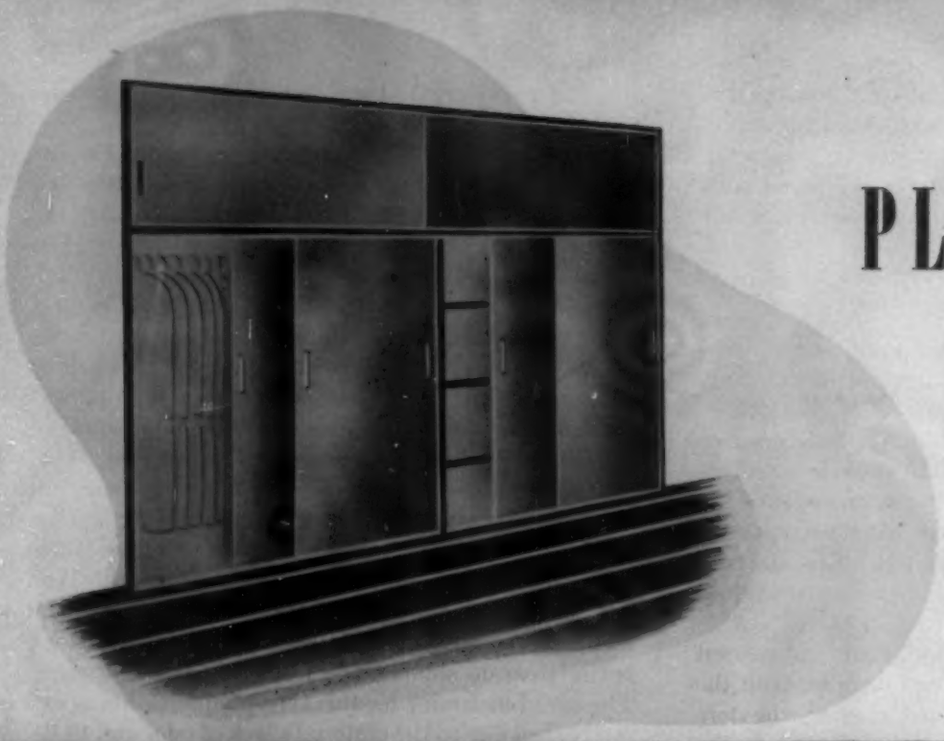
Although no recommendations have been made as yet, it is possible that at some future date chemically resistant flexible extruded tubing may augment aluminum for piping water to lavatories and food galleys on luxury air cruisers. Ordinary plumbing is rather heavy for planes and weight is of prime importance in carrying out speedy, economical on-schedule operations. Consequently, it will not be surprising if airlines turn to plastics not only for the faucets and soap dispensers but also for the wash basins in both the men's and women's lounges.

Airplane operating parts

There was considerable experimental work carried on during the war looking to the use of plastics for structural aircraft parts. While work remains to be done in this field, plastics are already playing an important role in many operating parts. For example, laminated plastics are employed for trim tabs, control cable pulleys and wheels, fairleads and control blocks.

While the parts described in the foregoing paragraphs represent but a few of the applications of plastics in air transportation, today and in the future, they give an idea of the "visioneering" going into the industry.

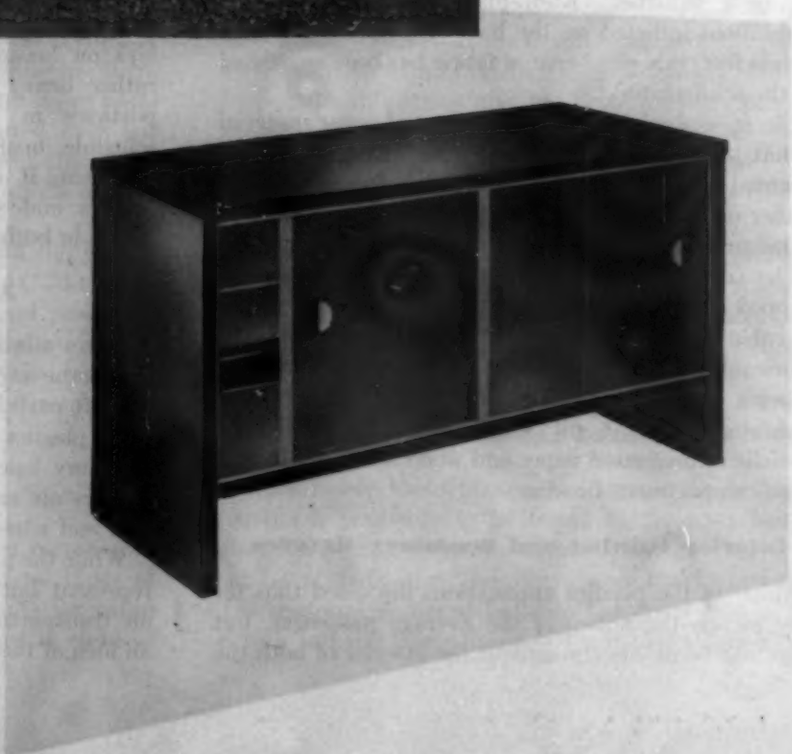
PLASTICS in



A low priced, easily produced plastic timber has been evolved in Britain for all types of construction. This built-in closet door might be made with a core of this material faced with wood veneer

Houses such as this one can have walls, ceilings, partitions, splash-backs and skirtings made of the plastic timber. Chemicals in the material render it both rot and vermin proof

PHOTO, BRITISH GOMBINE
ALL DRAWINGS, COURTESY BRITISH PLIMBER, LTD.



The plastic timber has attracted the attention of British furniture manufacturers who consider the wood-veneered type particularly well suited for use in modern furniture

Britain's postwar homes

A recently developed plastic timber promises to alleviate Britain's present shortage of construction materials

BRITAIN'S postwar housing presents a big problem which has to be solved quickly. More than half a million houses are wanted immediately; the estimated need over the next 10 years totals 4 million homes.

There is only one way to build houses quickly—by intelligent prefabricating. At one time Britain thought the solution to this pressing problem might be found in temporary prefabricated houses. This has not proved to be the case, and emphasis is now placed on erecting permanent houses, many of which are factory produced.

Into this new program of Britain's housing plans, plastics have made a dramatic entry. Hitherto, they have not played a big part in the constructional picture in England, the majority of laminated plastics proving too costly. And Britain's chief need is for low-priced, easily produced building material for walls, ceilings, flooring, etc., available in large quantities unhampered by supply problems. To meet this need Plimber,[1] literally plastic timber, has been evolved.

The result of three years' experimental work which was encouraged and assisted by the British Ministry of Works, Plimber is produced largely from waste products such as sawdust, sand, slate dust, straw, flax and sisal fibers, papyrus, elephant grass and other fibrous materials in varying proportions. These are first chemically treated and then bonded together with resins of the phenolic, urea, melamine and PVC. types.

Made in boards up to 3 ft. 6 in. by 8 ft. 6 in., these plastic timber panels can be sawed, drilled, nailed or screwed, and generally fabricated like wood. At present, this material is available in four densities: a low-density type for partitions; a high-density type with glazed weatherproofing finish making it suitable for exterior walling, table tops, etc.; a medium-density product for flooring or ceiling panels; and veneer-covered material that is made up in panels having a Plimber core faced with wood on both sides. This type is for use in furniture, cupboards, shelves, doors, etc.

Physical characteristics—In Britain the material has undergone extensive Government tests and been approved for building purposes for internal use. Some of the physical characteristics of a 1-in. thick panel are listed in Table I.

The chemical composition of the material renders it rot- and vermin-proof. It is available in a wide color range and its method of

[1] Product of British Plimber, Ltd.

High-density plastic timber, glazed and weatherproofed, can be kept clean with a damp cloth. For this reason it makes an excellent surface for doors and table tops

Table 1—Properties of 1-In. Thick Plastic Timber

Approximate Densities—35 to 60 lb. per cu. ft.
Tensile Strength—1/4 to 1 ton p. s. i.
Thermal Conductivity—0.80 to 1.2 B.t.u.
Bend Test—Modulus of rupture from 500 up to 2800 p.s.i.
Compression Test—Maximum crushing strength up to 4200 p.s.i.
Impact Strength—Steel ball dropped from height of 25 ft. without visible sign of damage on face of board.
Sound Insulation—35 to 50 decibels sound reduction factor.

manufacture ensures the consistence of the color throughout the board. The mixing of special ingredients with the raw materials enables novel effects and surfaces to be produced.

Mass production—The manufacturing process is designed to provide mass production at low cost. The machinery used in its manufacture differs considerably in design and operation from that normally employed in the plastics industry, since it must produce large panel sizes. Presses giving a pressure of 1/2 to 1 ton p. s. i. are much too expensive for the low-cost production work. Consequently, the makers of this plastic timber have evolved a simplified, cheap running press for their purpose. The whole process of manufacture is fully mechanized, and designed to produce the maximum output with the minimum labor on the flow production principle.

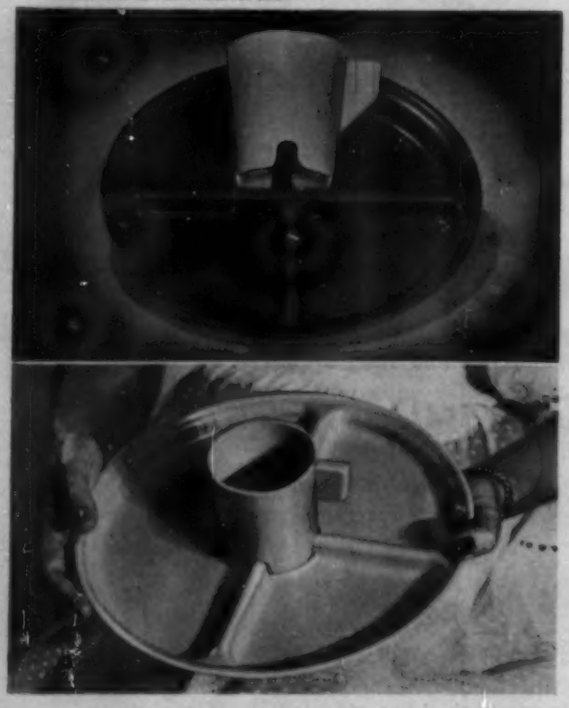
Although Plimber panels are produced in standard size (3 ft. 6 in. by 8 ft. 6 in.), they can be sawed to any measurement for specific purposes, e.g., for flooring it can be supplied in smaller units of, say, 2 ft. square. Incidentally, one of the most valuable economic factors so far as flooring is concerned, is that the material can be laid directly across joists, saving timber for flooring.

Use in Britains's postwar homes

Intended principally as a constructional material for walls, ceilings, partitions, flooring, doors, skirtings, splash-backs and the like, the use of the material is already being extended. The veneered type has aroused the interest of the furniture and radio industries, and plans now include the production of occasional and built-in furniture, using different grades of Plimber in combination with tubular steel, metal, glass and timber. Typical examples of tables, tea-trolleys, sideboards and built-in furniture are illustrated in the sketches on pages 108 and 109.

NOT CONTENT MERELY TO USE THE conventional "blue plate" design for its plastic Nuplaware, New Plastic Corp. has produced a plate and cup set which is not only unique but a decided convenience to those who must eat a complete meal without benefit of dining table and dining room. The handy arrangement will no doubt receive enthusiastic support from the anti-cup-juggling faction.

PHOTOS, COURTESY NEW PLASTICS CORP.



Ideal for picnics and parties, the tableware is compression molded of urea- or melamine-formaldehyde in a design that is essentially functional. Notches in the extended lower edge of the cup fit nicely over the low walls dividing the plate into three sections. Cup or plate may thus be used together as a compact unit or separately if desired. Ridges on the cup handle make it easy to grasp. Should either cup or plate be dropped, however, the catastrophe would be diminished by the fact that the plastic material is much less easily broken than china or earthenware.

Urea and melamine being non-toxic, odorless and tasteless have no unpleasant effects on food which comes into contact with them. Neither will the food or liquid, however hot, act upon the plates or cups with any dire consequences as the dishes will withstand fairly high temperatures and may even be washed in boiling water if necessary. Soaking for any great length of time in either cold or hot water is not recommended, however.

Cafeterias, institutions, hospitals and schools will probably be one of the largest groups of consumers for the tableware. A considerable foreign market has also been opened up and the dishes have already been exported to England, Sweden and Mexico.

SMALL... but the real thing

The model maker's plane and the balsa stripper, which are both molded from polystyrene are precision instruments for handicraft work

WHEN Sundel Doniger, president of X-Acto Crescent Products Co., manufacturers of surgical instruments, obliged his advertising assistant by making him a retouching knife with interchangeable blades, he started something that has grown into big business—big business that has turned to plastics.

This first knife, when put on the market, proved so popular that it was followed by two more, one for photo retouching and one for silk screen stencil cutting, then by others for chip carving and model making. With the development of balsa wood model airplane building as a national hobby, came sets of knives in cases, sold through hobby stores, hardware stores and artists' supply shops all over the nation.

Now two new items have been added: a model maker's plane and a balsa stripper, both molded by Consolidated Molded Products Corp. from black Styron. Although small in size, there is nothing of the toy about either of these tools. Both are professional craft precision instruments. Starting from a rough sketch, the molder engineered the job, handling mold design and construction as well as the processing.

The plane can be used for delicate work as well as heavy-duty planing and shaving, being strong, well-balanced, and equipped with a high carbon surgical steel blade. It is molded in one piece with no inserts. The polystyrene gives good dimensional stability; the bulk of the piece provides good impact strength. After molding, a hole is bored through both sides to accommodate the blade pressure bar, the steel bottom plate is clamped over molded-in ledges and the job is assembled.

The stripper is designed for use with two of the X-Acto knives, guiding the blade in cutting strips of balsa $^1/_{16}$ to $^1/_2$ in. wide out of stock $^1/_{32}$ to $^3/_{16}$ in. thick. Here precision is urgent. The stripper is made in two parts: the block from black polystyrene and the bottom guide plate from red polystyrene. The black piece has female guides into which male slides fit on the guide-plate. This construction makes it possible for the slides to be set in parallel positions across the stripper bottom. A white line in the red guide-plate meets white lines $^1/_{16}$ in. apart in scale at the front end of the block. All these lines are molded into the plastic pieces, and the color wiped in during assembly.

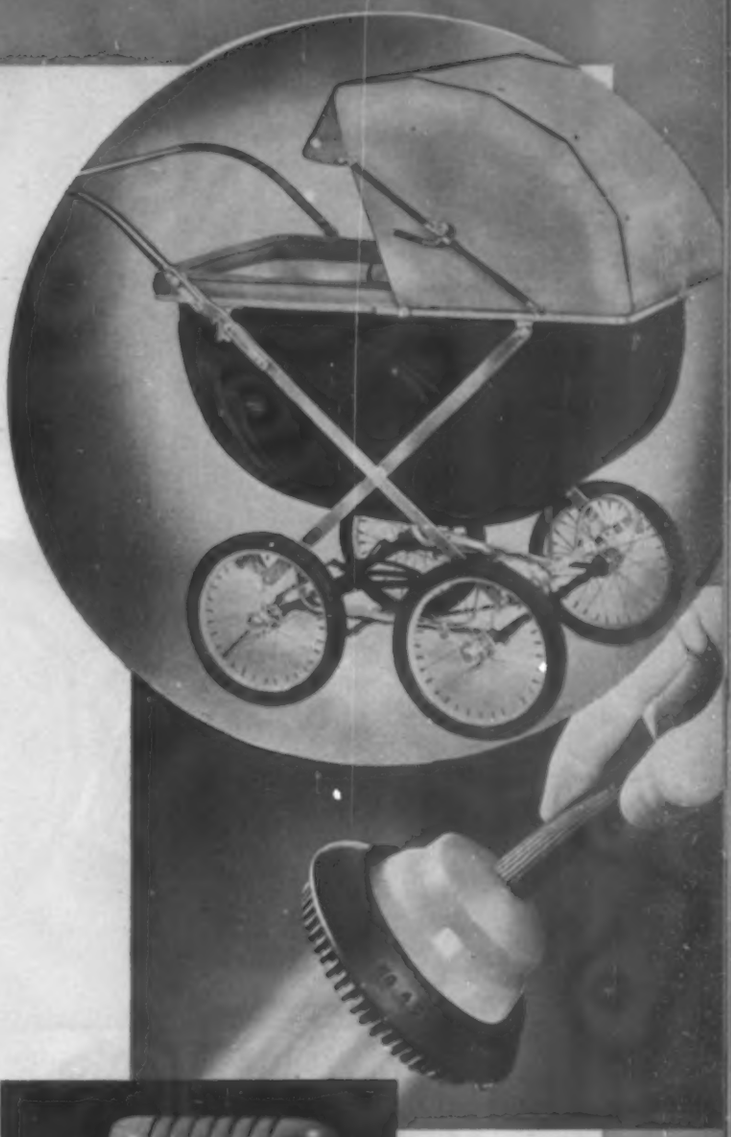
Considering that the hobby field is now a $25,000,000 proposition and constantly growing, having shown a 140 percent increase over the past 5 years, this instrument company's enthusiasm for the model tools is understandable. So also is its enthusiasm for plastics, since the products must be made of materials that are light in weight, that can be formed to fairly complicated contours, that have strength.

Luxurious piece for a festive room is this Lawrence & Hunter buffet which utilizes two plastic materials. Shiny, smooth-surfaced, black Catalin is used to face the hardwood body. The drawer pulls are fabricated of Lucite rods and the risers, that form the base and hold up the glass top, from heavy sheets of this same material. Mario is the designer of the buffet →

← That the less fortunate may hear better, Telex, Inc., has developed a noise suppressor which reduces cord friction noises which occur with the use of vacuum tube hearing aids. Its case is black Bakelite, compression molded in a 6-cavity positive type mold. The suppressor comes in a close-fitting box with instructions

← You've got to be good to fool a duck but it can be done with a decoy made by Wildflowers Decoys, Inc. With Urac, a water-resistant resinous adhesive, the company glues the head and base of the duck to a pine body. In testing the efficiency of the decoys they were floated in water for long periods and neither buoyancy, coloring or the resinous bonding was affected

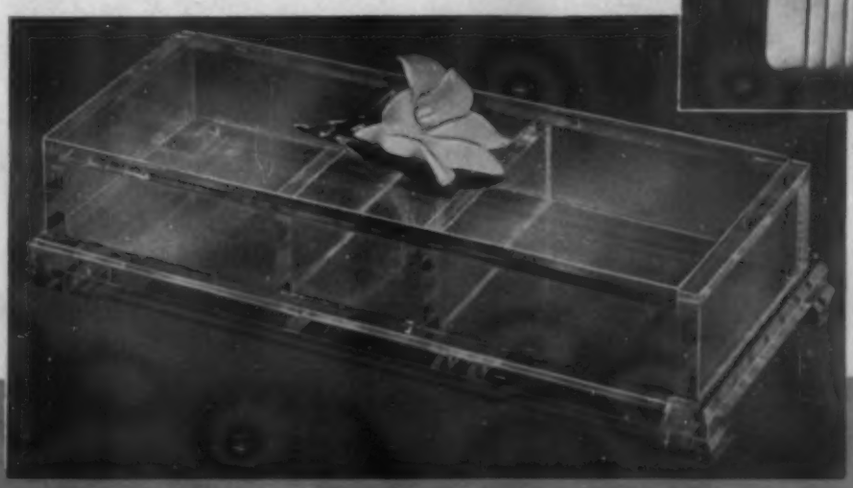
PLASTICS IN REVIEW



Baby can now go bye in a carriage which has body and hood covered with Terson, a resin-coated fabric. Athol Manufacturing Co. developed the leather-like material which resists sun and rain and has a long life span. Because it is also resistant to cracking, abrasion, puckering and because it has good elastic properties, the fabric appears to be well suited for use in hoods and folding carriage bodies →

Singing in the shower will be inspired by this nozzle which is injection molded of polystyrene. Available in five colors, white and in several mottled shades, the unit is suited for use in shampooing, bathing the baby and in similar operations where the water temperature does not exceed 150°. The head is fitted with a perforated disk cemented in the throat, Controla Mfg. Co. distributes the head →

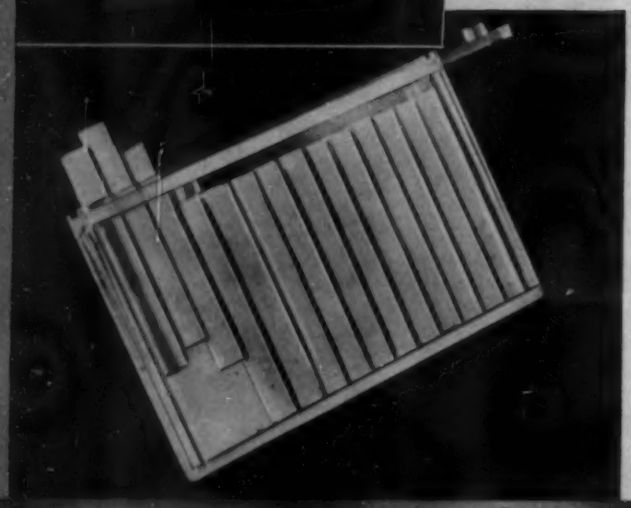
This little flashlight (3 in. in length) is a Kleig light in its own right. It throws a good beam and holds two batteries. The Connecticut Plastic Products Co. molds the cap and shell of Tenite for Cresale, Inc. The cap holds the switch and the light while the batteries are housed in the body. An undercut, molded in the cap, allows for a positive closure →



← A box can always be put to good use around a house—especially when it can conveniently accommodate articles ranging from jewels to cigarettes. Scattergood of Hollywood fabricates this one of either Plexiglas or of Lucite

PLASTICS IN REVIEW

← Here is something new in light plugs—one which combines a pilot and safety night lamp with two outlets for the attachment of lamps and other appliances. The two parts of this LumiNite safety pilot plug, a product of the Associated Products Co., are at present being compression molded of ivory Plaskon by the Yardley Plastics Co.



← A case for ladies to judge is this cigarette case made and distributed by Fairyland Plastic Products Co. The front, back and bottom are fabricated from a Lucite sheet. Side strips are fitted into place and glued. The top strip slides in grooves and has a knob on the underside which acts as a stop and one at the top which acts as a knob

← All in all, a stamp pad gets some pretty hard use! A good one must withstand over-zealous blows, silence them and not move excessively. When faced with rubber and metal shortages, the Bates Manufacturing Co. satisfactorily converted to rigid Vinylite for both top and bottom of the case. The Sterling Plastics Co. molds both parts

On a Toot - A - Toon → Trumpet you can do just that. Universal Plastics Corp. molds this plaything of cellulose acetate in a variety of colors for Tot Tested Toys, Ltd. The two halves are acetoned together under pressure

A little limestone, some salt and some coke, plus the know-how of mixing them are responsible for the modernization of this breakfast nook. From them has come Koroseal in many forms. Tape-like strips of it are used to weave the backs and seats of the chairs (designed by Hans Knoll); a spaghetti-like extrusion is wound around the face of the clock as a trim; a sheet of it covers the table. Curtains are made of Koroseal marquisette. The colors are gay but best of all is the ease with which these vinyl compositions take the drudgery out of a day's housework. It is stainproof, waterproof as well as weatherproof →

← Fine for tea parties and other uses where the liquid to be strained does not go above the boiling point of water, is this Styron strainer, molded by Plastic Metal Manufacturing Co. An interesting feature is the way the bottom metal mesh is molded right into the edge of the plastic

← A bright future can safely be predicted for a stocking drier that is attractive, durable and has a smooth surface. That is why enthusiasm runs high for this drier produced by Olympic Plastics Co. for the Nik-Nak Company. Molded of Tenite II in a variety of colors, the rack holds half a dozen stockings and can be hung on a shower curtain rod, towel rack or other similar household fixtures

PHOTOS, COURTESY BAKELITE CORP.

1—*The upright vacuum cleaner has nameplate of ethyl cellulose and cord clip, button, hose and coupling shank injection molded of cellulose acetate. Other plastics going into this vacuum are elastomeric vinyl compounds and phenolics*

2—*An elastomeric vinyl compound is used in the bumper and the bag grip for the upright cleaner and in the holder for the dust brush, an attachment which can be used with either type cleaner*

Adding color to vacuum cleaners

Metal, wood and rubber are giving way to plastics in this new home cleaning system

WHAT does the housewife want in her new vacuum cleaner? Based on 35 years' experience in the field, the Eureka Vacuum Cleaner Company's answer to this self-posed question is a complete home cleaning system that can do all the sweeping, waxes the floors, dusts, brushes, demoths and even sprays paint. Of particular interest to the plastics industry is the fact that this answer has meant a marked increase in the company's use of plastics parts.

Plastics have brought color to this newly designed cleaning system. Where parts were formerly limited to neutral metal finishes, they can now be produced of either thermosetting or thermoplastic materials in hues that harmonize with any interior. While the first post-war models are maroon, the day is fast approaching when full advantage will be taken of the colorability of both thermosetting and thermoplastic materials.

There are other properties of plastics that are of special value to vacuum cleaner manufacturers. Light weight and strength are of particular importance in an appliance that must be moved from attic to cellar and be subjected to countless knocks and bumps. And the fact that plastics offer a smooth lustrous finish that will not chip off and can be cleaned with a damp cloth probably had much to do with their adoption in this unit.

There are really three parts to Eureka's complete home cleaning system. *First* there is the upright vacuum for rugs, carpets and floor coverings. The lightest ever made by this company, the machine operates with a two-mile-a-minute vacuum power and has a sealing action that lifts the end of the rug as the cleaner reaches the edges. The *second* piece is the tank-type unit which is particularly well adapted for all above-the-floor cleaning chores. A combination of newly developed interchangeable cleaning devices for both vacuum units comprises the *third* part of this cleaning system.

The upright model

Four different types of plastic materials are used in this sweeper: Bakelite, Durez, Ethocel, Lumarith, Tenite and Vinylite.

Perhaps the largest single part is the molded phenolic

3—Molded of phenolic are such parts as the upright cleaner hood and coupling rim, the sprayer head and demother. 4—Attachments like floor and wall brush, crevice tool, upholstery nozzle are cellulose acetate

3 PHOTO, COURTESY BAKELITE CORP.

4 PHOTO, COURTESY CELANESE PLASTICS CORP.

motor hood which combines light weight and high strength with a fluid design. The wheels of this model are also made of phenolic as are the motor end, the front and rear covers and the Attachomatic rim which permits the use of the various cleaning tools on this style vacuum.

Smaller plastic parts on the upright include an ethyl cellulose nameplate and a cellulose acetate switch key. The cord clip, handle grip and the hose and coupling shank are also molded of cellulose acetate.

The bumper, an extruded belt-like strip which runs around the base of the upright sweeper to protect furniture, walls and doors from marking, and the injection-molded bag top guard, a piece which acts both as a closure for the top of the dust bag and as an attachment to the handle, employ a vinyl elastomeric compound. The residual elasticity possessed by this plastic is of particular value in these two applications. Then, too, the materials do not oxidize or harden and crack, and they do not rub off, mar or scratch walls, doors and furniture.

The tank-type cleaner and attachments

There are but three plastics parts on the tank-type cleaner, and these duplicate the pieces used in the upright model. They are the molded phenolic wheels and the cellulose acetate hose and coupling shank and switch key.

Elastomeric Vinylite, Bakelite, Durez, Lumarith and Tenite are the materials used for the various attachment parts and tools that are part of this home cleaning system. The use of plastics in these parts is a departure from Eureka's prewar practice. With the exception of the demother, all the old attachment parts were made of metal, all the tools of wood, metal or rubber. When George Walker completely restyled this line, a switch was made to plastics for almost all the attractive attachment pieces.

The only vinyl part in this group is the dusting brush holder; the only molded phenolic pieces are the body and cap of the demother and the demother sprayer head. Cellulose acetate is the material from which the crevice tool, the upholstery nozzle and the floor and wall brush are injection molded.

Easy to clean themselves, plastics are adding a brighter, cleaner note to this new complete home cleaning system. Before too long the use of plastics should become even more obvious as more and different colors are incorporated in the plastics from which the parts are molded and extruded.

Spring-tension fastener

It's an open and shut case that Harriet Hubbard Ayer has designed for her talcum powder—a case that employs a push-on type Speed Nut in its sifter top closure. The ingenious device provides just the right amount of pressure for opening or closing the top without undue strain, at the same time preventing the sifter from opening accidentally.

The dispenser top is composed of two parts—a metal box top and a plastic cover. Stamped in the metal cover is a hole specially shaped to permit entry of the integral stud and shoulder of the plastic cover. The Speed Nut is zipped on this 1/4 in. diameter stud, its prongs biting into the plastic for a spring tension grip. When aligning the holes the plastic cover can then be rotated to the right or left only a limited number of degrees, due to the shoulder of the plastic cover striking against the sides of the cut-out of the metal top. Leakage of powder is prevented by a paper gasket between plastic and metal parts.

Manufactured by F. N. Burt Co., the powder dispenser is a pretty safe bet for traveling where leaky containers are always a hazard or for use at home where a tipped powder box ordinarily creates such a mess on dressing tables.

Designed for *Baby*

ONLY the best for baby. That is the guiding rule of every manufacturer of infants' goods. "Is the best material for the purpose being used? Is the texture and finish of the finest? These are the important questions. Such matters as ease of production are secondary.

The infant's training seat made by Kiddie Seat Corp. was designed with these two questions constantly in mind but proved to be a smooth item in the production line.

Injection molded in a single shot by Worcester Moulded Plastics Co. this 16-oz. training seat exemplified the high standards that can be achieved in the molding of polystyrene in large pieces. Both Styron and Lustron are used in colors of ivory, white, blue and pink. Polystyrene was chosen for this product because of its dimensional stability, its light weight and ease of finishing.

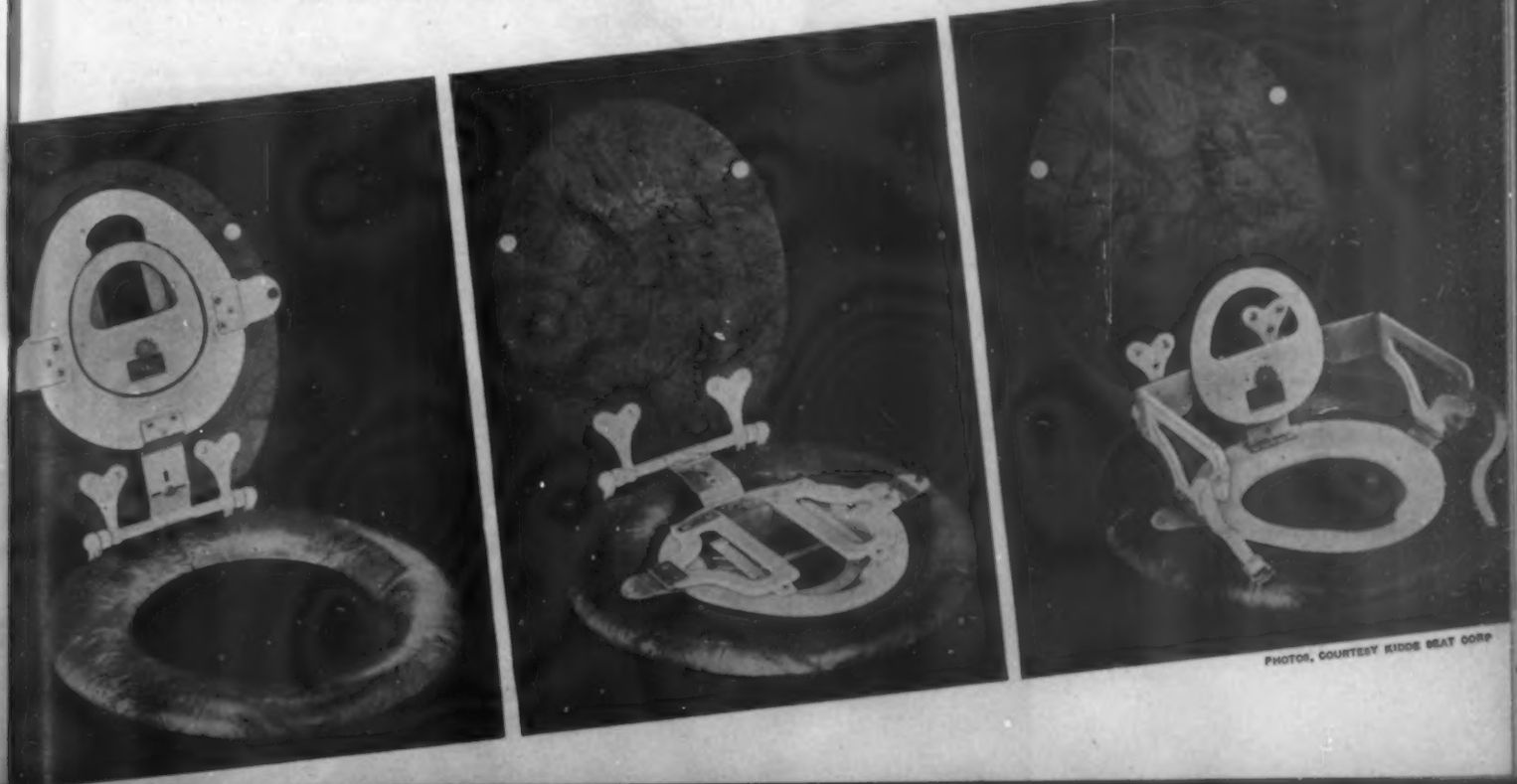
Problems encountered in molding were: flash, occasioned by the necessity of high density; weld marks; difficulty of holding the whole sprue flat after molding. The flash was overcome by careful attention to cycle time and to mold design. Weld marks were eliminated by means of wider gates and faster flow through the mold. Maintenance of flatness in surfaces was achieved by immersing the whole sprue in water immediately after injection.

The individual polystyrene parts are shipped to the manufacturer of the seat and are assembled in his plant in an interesting combination of chrome metal hinge parts and plastic components. The ingenious patented hinge design makes it possible for the back and arms of the trainer to be folded up, leaving the seat completely collapsed when not in use. The unit may be permanently attached to the back bar of the toilet seat at all times.

This seat is an example of the large pieces that can be molded of polystyrene

All four polystyrene parts that comprise this infant's training seat are injection molded in a single shot

Compactness and collapsibility are important features of this infant training seat which is attached to the back bar of the toilet. Three stages of unfolding it are shown



PHOTOS, COURTESY KIDDIE SEAT CORP.

Molded textile scroll condenser

This is an instance where a small phenolic unit did a job well, forecasting a bright future for plastics in the textile field

A PHENOLIC scroll condenser developed for use in the roving system of modern textile mills is a fine example of a product in which plastic has proved superior to any other material. Perfected and patented by H & B American Machine Co. and compression molded from Bakelite by Northern Industrial Chemical Co., the small unit has a spectacular record of success in its task of guiding the fibers of cotton while they give half a twist to form the yarn.

Different materials tried out

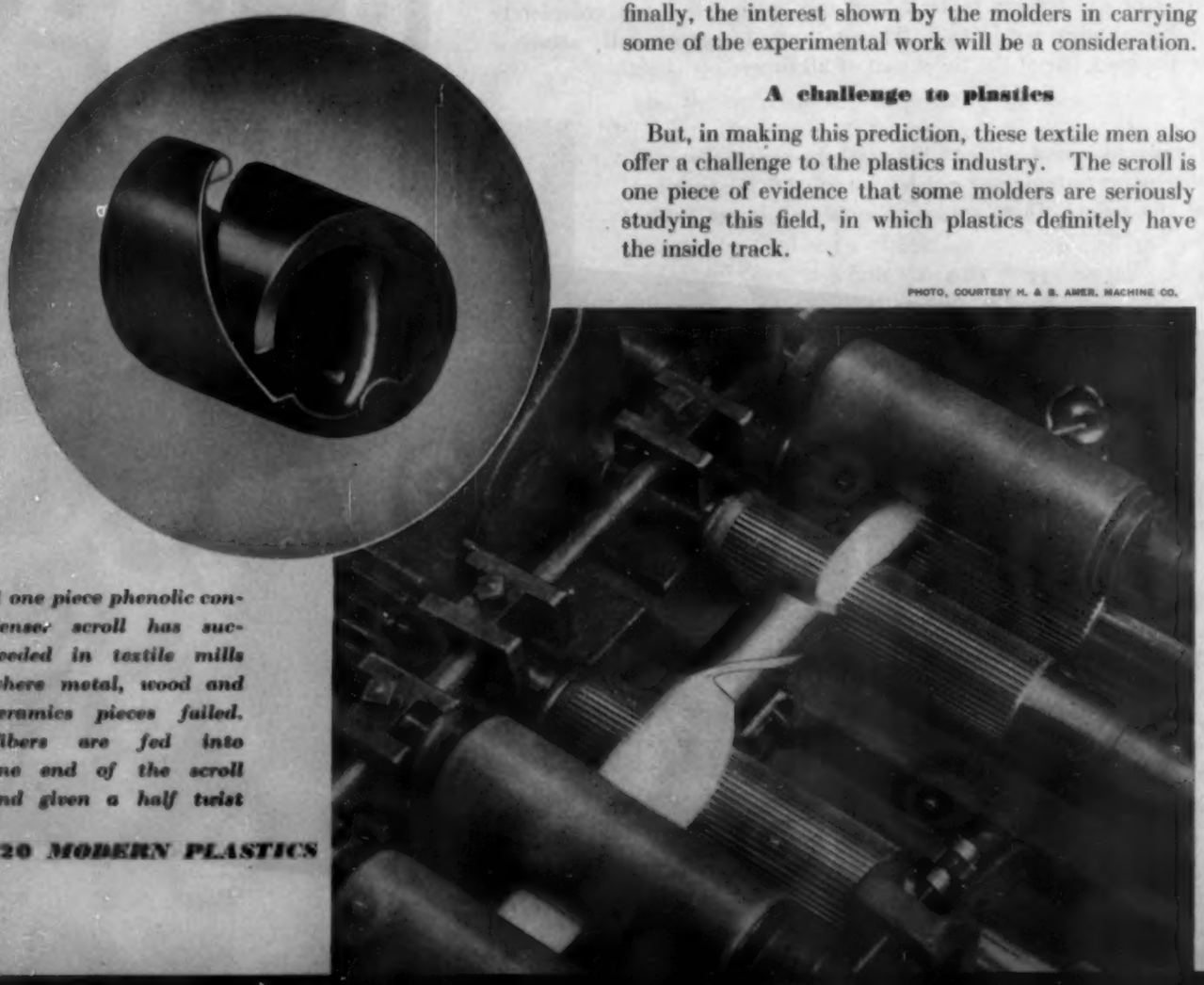
The first experimental scroll condenser was made of metal. It took a jeweller to make it and the cost in commercial production loomed far too high. In addition, it tarnished and acted as an electrical conductor. Pottery was investigated next and was found too apt to chip and ruin the fibers. Wood was too soft and difficult to keep clean. Plastic provided the answer, being a non-conductor of electricity, non-tarnishing, non-chipping and impervious to humidity conditions. Several hundred thousands of these scrolls have been in operation long enough to prove their worth and the company has yet to see one made of plastic which has had to be replaced due to wear.

According to E. J. McVey, executive vice-president, and Daniel Walsh, product development engineer of the H & B American Machine Co., plastics may be expected to have an increasingly large role to play in the textile machinery industry, for in addition to the qualities already mentioned they will help to promote clean and efficient plants. This, in turn, should have a beneficial effect upon labor relations and better quality production. Plastics offer the textile industry better control of many factors which would ordinarily be a constant headache: static electricity, human perspiration in machine operation, smoothness of operation at high speeds and humidity in the air or in the fibers being handled. And then, of course, the price of plastic parts will to some extent control their use in this machinery. The ability of the molders to make long and large flat pieces which can be guaranteed against warp will be another factor, since some of the future development will no doubt involve this type of part. And finally, the interest shown by the molders in carrying some of the experimental work will be a consideration.

A challenge to plastics

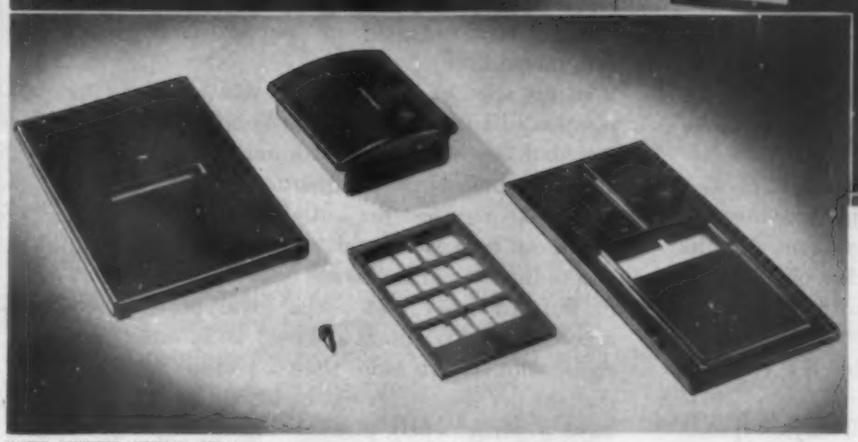
But, in making this prediction, these textile men also offer a challenge to the plastics industry. The scroll is one piece of evidence that some molders are seriously studying this field, in which plastics definitely have the inside track.

PHOTO, COURTESY H. & B. AMER. MACHINE CO.



A one piece phenolic condenser scroll has succeeded in textile mills where metal, wood and ceramics pieces failed. Fibers are fed into one end of the scroll and given a half twist

Eye testing demands accuracy



PHOTOS, COURTESY AMERICAN OPTICAL CO.

The stereopter, used to measure depth perception, employs five molded phenolic parts: left (top row) front plate and battery case, (bottom row) trigger switch, target and back plate

by H. E. HASENZAHL*

THE Verhoeff stereopter, an assembly of five molded phenolic parts, has a two fold claim to the name *tester*. Used by ophthalmologists and optometrists in measuring depth perception, this eye-testing instrument must function with the greatest accuracy and so it is also a tester of materials, of the ability of phenolics to be molded to close tolerances in intricately designed parts, to be formed with accuracy into parts with thick and thin cross sections and feather edge cutoffs.

The five molded parts comprising the stereopter, which weighs less than a pound and measures $7^1/_8$ by $4^1/_4$ by $1^3/_4$ in., are a solid back plate, a front plate with a rectangular target window, a test target designed with three vertical bars of varying sizes and a battery case (see above).

The grilled test target plate is designed so that it can be shifted up or down inside the assembled housing. By reason of this arrangement a patient can view four test targets, each of which comprises one of the four horizontal sections in the target plate. One bar in each of these sections is either in front of or behind the plane of the other two vertical bars. Between the near and far bars there is a difference in depth of 2.5 millimeters. The examiner holds the stereopter a predetermined distance from the patient's face and the latter must decide whether the left, center or right bar is nearest or farthest from him. A quick shift in the position of the plate brings another section of vertical bars, with its differently spaced bars, before the patient. The index opposite this shifting knob tells at a glance the correct answer for the position of the bars. Although there are but four target combinations, by simply inverting the instrument the positions of the targets are reversed. Thus eight different tests can be made.

Durez was selected for all the molded parts in this

* Plastics Development Engineer, American Optical Co.

instrument, partly because of its ability to withstand warping on pieces of varying cross section. This variation amounts to from 1/8 to 5/8 in. in the 6-in. long front and back plates, yet both parts had to be molded free from warp since they were so designed as to telescope together.

These two parts are compression molded in a semi-automatic self-contained press, the molding cycle lasting 3 1/3 minutes. High-frequency preheating is used to make ready the 9-oz. preforms. The window opening in the front plate is molded to a feather edge having a bevel inward to eliminate any possibility of the patient observing the 1/8 in. thickness of the material at this section. The opening was held to a tolerance of ±0.002 in. on both the width and length of the window.

The target containing the vertical test bars is produced in a single-cavity hand transfer mold, a very small trigger switch being molded in the same die. Here again accuracy is a prime factor, the overall dimensions being held to +0.000, −0.005 while the individual bars in the target were held to ±0.001. The bars are molded to a feather edge and, like the front plate, beveled inward to eliminate any possibility of depth perception of the thickness of the bar. This target and the front piece are both sand blasted in order to reduce any reflective images.

The battery case, the fifth plastic part, is molded in a hand transfer mold in a 4-min. cycle. As with all the other preforms, the material for this piece is preheated by high-frequency. The battery case presented another problem of thick and thin cross sections. In a finishing operation, the cylindrical section on the inside of the case is sprayed with a non-reflective white coating to give the effect of diffused illumination.

S.P.I. Low pressure conference

Wartime achievements and peacetime potentialities of low pressure molding and fabricating keynoted the first annual conference of the Low Pressure Industries Division, Society of the Plastics Industry, held at the Edgewater Beach Hotel, Chicago, February 1 and 2.

Total registration numbered 225. J. E. Stokes, Bakelite Corporation, headed up the meeting committee, while Robert J. Brinkema of the Egmont Arens organization served as chairman of the promotion and display committee. Detailed conference arrangements were supervised by Charles Condit, secretary of the S.P.I. Engineering and Technical Committee.

Products displayed embraced all major types of resins, fillers and production techniques. Numerous decorative and utility type laminates for a variety of applications were exhibited along with a number of large intricate items.

Two of the six talks presented before this conference are published in full in the Engineering Section of this issue. "Reinforcing low pressure molding" by John P. Lincoln appears on pages 138 through 139. "Postforming methods and applications" by William I. Beach is to be found on pages 142 through 145.

Roy B. Anderson of the Wipe-On Corp. discussed "Protective and decorative finishes for low pressure laminates." According to Mr. Anderson, the principal requirement for a finish coating is long life. This means there must be adequate adhesion and sufficient flexibility for the finish to give with the laminated material when it is under mechanical stress or when subject to temperature changes. Preparation of the laminate surface is a primary factor in the attainment of satisfactory results—the type of putty or other material used, method of filling joints, etc., meriting close study.

In his speech, "The Naval architect looks to plastics," Philip L. Rhodes of Cox & Stevens, Inc., stated that while plastic materials make possible great economies in hull construction, the industry must take care lest the initial cost advantage be wiped out by expensive fitting-out costs since the cost of the average hull is not more than 50 percent of finished boat cost. The ideal plastic hull according to Mr. Rhodes should be in one piece, should not absorb more than 2 percent moisture content per season, should be light in weight and have a permanently molded finish.

William J. Connelly of the Bakelite Corp., in speaking of "Present products of the low pressure industry" discussed the three principal types of resins used by this industry—phenol-formaldehyde, the amines and thermosetting ester resins. Pressures, he said, range from 1/4 lb. to 500 lb., the bulk factor directly influencing the minimum pressure that may be applied. Mr. Connelly also discussed the various processes used in this type of molding.

In his talk on the "Future trends in the low pressure field" Egmont Arens, industrial designer, expressed the opinion that low pressure laminating will make possible a tremendous amount of experimental work on boat hulls, since the medium is flexible as compared to wood and other materials. Low pressure molded auto bodies, according to Mr. Arens, will compete with steel on custom-built jobs. Use of these materials in light aircraft, station wagons, trailers, etc., also appears likely.

The undercut sections in the brush back and mirror frame presented the chief problem in the injection molding of this three-piece methyl methacrylate dresser set. In the final design, a slot was provided at the top of each of these two parts which enables the operator, as shown below, to spread the undercut sections and thus facilitate the removal of the parts from the mold

Dressing table sparklers

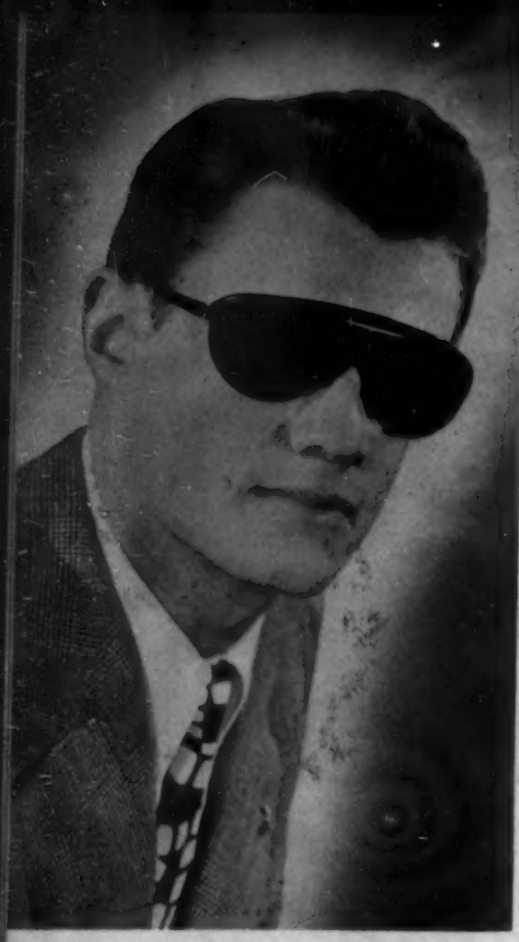
ONE of the minor, but none the less widespread, reactions to the end of wartime restriction is the increased demand for *decorative* home accessories. This trend has meant the renaissance of one of the old standbys of the plastics manufacturer—the dresser set. The injection-molded Lucite set above, of which more than a million have been produced during the past year, is typical of these combs, brushes and mirrors.

Except for the comb, all the plastic parts in this set are produced by Tech-Art Plastics Co.—two brush backs, two mirror frames and six clips being molded in a 10-cavity die. The comb is produced in a 12-cavity mold by the Associated Novelties Co. which assembles and distributes the complete set.

Since the brush back and mirror frame contain undercuts into which the mirror and brush assemblies fit, it was necessary to design these two pieces so that they may be easily removed from the mold. This problem was solved through the provision of a slot at the top of each piece which enables the operator to spread the undercut sections.

Little finishing is required beyond the trimming of the sprue and the wet sanding of all the parts. A modified milling machine is used to remove the inside flash; the outer flash is cut away by hand.

The floral design that is molded into these three dressing table pieces was worked out in such detail that even the petals of the roses and the veins in the leaves are clearly evident. To complement this surface pattern, the manufacturer inserts colorful printed sheets under the clear cellulose acetate backs of the brush and mirror. Then, after the mirror and brush are fully assembled, the molded clips are cemented over the slotted top opening. These clips serve to conceal the cemented joint and to hold the split frames together.



AMERICA'S sun worshippers will be the lucky beneficiaries now that the Polaroid Sportglas, product of the American Optical Company, is being mustered out of the Service. For the war has taught us many things and one of these is the grave effect which glare from sunlight, whether at the sea shore or on snowy hillsides, can have upon the eyes.

A few changes have been made in the goggles by their creators in order to better adapt them to civilian use but essentially they remain the same goggles that served our soldiers so efficiently.

The frame is injection molded of Tenite II in four parts. These consist of two temple bars, the nose kicker and the brow bar. Each temple bar is equipped with a flexible metal tube, one end of which fits over the ear, the other screwing into the plastic bar, in this manner providing a simple means of adjusting the sun goggles to fit the individual wearer.

The lens is made of laminated sheet stock with the glare-removing Polaroid polyvinyl alcohol material sandwiched between the sheets.

This goggle is designed to rest against the brow, the lens being of the single aperture type in order to assure the fullest vision. Destined to please the American public, who when at play loves nothing better than colorful clothing and colorful accessories, the gay butyrate frames are made in such varied shades as red, blue, ivory, green, amber.

In merchandising the product, an outstanding piece of informative labeling is used. This includes instructions for cleaning the goggles with water or by means of the "breath blowing" method, and issues a warning against wiping with any abrasive material or with gasoline, or submerging them in hot water. The label is printed on a folder which is cut in the shape of the goggles and folded in such a way as to cover both front and back of the lens.

PLASTICS

FOREVER seeking something new in plastics, General Electric Co. has brought out a special vinyl formulation which effectively seals the ends of metal tubes against air, water or dust. Extruded in the form of hollow tubing, the plastic material is first cut and, crimped at various lengths, then marketed as sealing caps or, without being crimped, as sealing sleeves.

Sold with the plastic pieces is a solution known as G-E No. 12501 Dilator in which the plastic caps or sleeves must be soaked for a 5-hr. period prior to use. In the solution they expand half again as large as their normal size. While still dilated they are placed in position over the tube where they shrink to the desired size, form an airtight fit.

The water-resistant material was developed to keep dust and moisture from the interiors of metal tubing in refrigerator condenser systems during manufacture. But new uses are cropping up daily. As sleeves they seal the joint between two telescoping tubes in condenser systems. Or their bright colors (red, blue, green, yellow, orange, white and transparent) may dictate their use as lead markers for wires and cables. Good insulation properties make them ideal as coverings for bus bars, wire cleat insulation, noise dampeners on machinery.

Special heat-resistance requirements can be fulfilled by different formulations of the compound. The caps can be crimped or the sleeves cut at any length, with a trade mark added if desired, and can be produced to specified diameters and thicknesses to meet the individual needs of the manufacturer.

COIN fed plastic pigs that squeal with delight when bits of copper and silver come their way should make children economy-wise.

These pert piggy banks, manufactured by Toy Town Co., are injection molded of cellulose acetate by Tech-Art Plastic Co. There are four parts including the two halves of the body and the closure in the bottom of the pig which permits removal of the money. The latter is made in two pieces as the design of the catch is such that it could not easily be molded.

Finishing operations are fairly simple. The gates, which come at the nose of the body, are sawed off and the flash trimmed from the slot in the back of the pig. At the same time flash is sanded from the two parts of the closure. Next the upper and lower halves of the body are acetoned together, as are the two parts of the closure, and the joint buffed.

In present production the eyes and nose are painted on the pigs. However, in the future the color for these features will be printed using a foil, the white eyeball printed first, then the blue pupil overprinted in the corner of each eye. The nose will be printed in a color which contrasts with the body tint and the nostrils colored in black.

In a final operation the noise maker is dropped through the opening in the bottom of the pig. The banks are made in yellow, red, pink and blue.

PRODUCTS

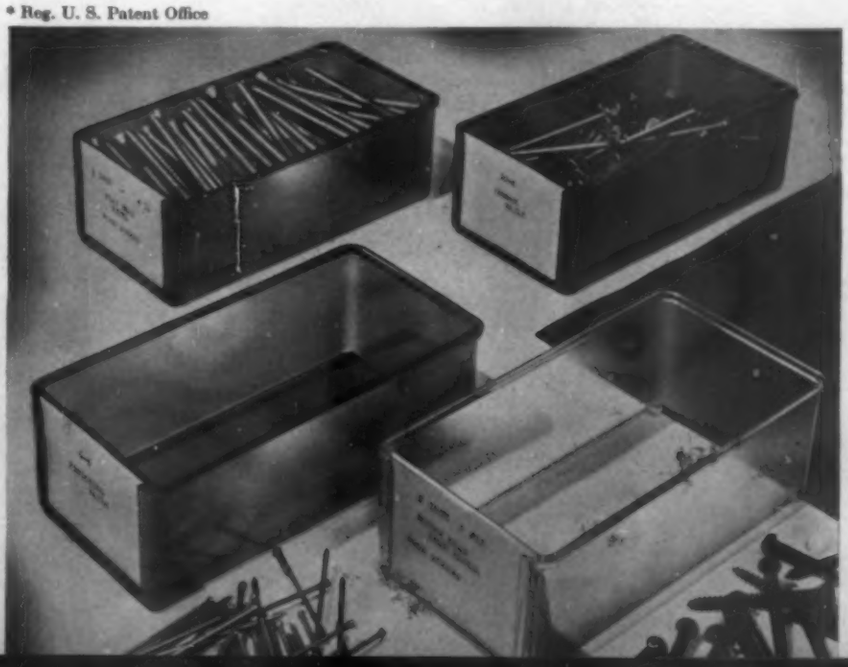
TO INSURE accurate and efficient handling of small lots of dental burrs as they move from one machine or operation to another in the plant of S. S. White Dental Manufacturing Co., each batch is placed in a parts box molded of transparent Lumarith XF. These come in one size only and are molded so that they can be tiered, one on top of another, the small nubs or feet fitting onto the open top of the next box. Brackets in one end of the box forms slots into which identifying cards can be slipped. These cup-like grooves present no molding problems since the boxes are injection molded in a single cavity straight draw mold.

Finding just the right material for a job such as this was not as easy as it might seem. Although one requirement was transparency, there were other equally important considerations. The box had to be of a size to carry $2^3/_8$ lb. of dental burrs—a heavy load for a small box. Furthermore, these burrs are treated with an anti-corrosive substance which affects some plastics. Some materials that were tested came through the load test successfully but failed in toughness, the small feet breaking away.

When the search was finally narrowed down to cellulose acetate, it was found that many acetates lacked the strength necessary to carry the load. Acetate compounds of the flame-resistant series, however, met specifications.

The production of the boxes in attractive colors served as a means of instantly identifying the contents. Thus the containers do well as storage boxes.

* Reg. U. S. Patent Office



AMONG the many interesting wartime plastic developments is a thermoplastic material with a non-critical asphalt base and a resin binder. Given the name Consite, it has been shown to have good dimensional stability, electrical properties and heat resistance. At present the material is available in black only, requiring a spray finish to impart color. However, the company is hard at work developing a compound which will have integral color.

A poker chip rack and two styles of silent butlers are three of the variety of household items which Consolidated Industries presently produces from this material. Injection molded by Phoenix Products Co., they are sprayed with a special lacquer and infra-red baked to provide a durable finish.

The Sportsman poker chip rack is an attractive two-tone article which comes in three pieces. The base and rack proper is black, provides space for two decks of playing cards and 200 chips, and is really a unit in itself. Two detachable covers fit over this, serving not only to protect the cards and chips but to provide a convenient carrying case as well. Handles are molded into both pieces so that when the covers are in place they combine to offer a firm grip. The covers are either red or black, making the rack a decorative ornament as well.

The silent butler which comes in two styles, rectangular and round, is injection molded in two pieces. A convenient grooved tab for opening with the thumb is molded on the top part. The only non-plastic part is a metal hinge pin. The circular style is offered in three colors, whereas the other silent butler may be had in ivory, red, jade, Wedgwood blue, bronze or silver.

PLASTICS

IN MUCH the same way that an electrical thunderstorm clears the air outside, the Electroaire Ozonator produces ozone which removes considerable smoke and other odors from a room.

For purposes of appearance and practicality, the electrical device is housed in a case of Catalin or Bakelite. Openings for the perforated brass screen and the metal switch panel are molded into both types of housings, as are the small feet on the bottom of the case. Flash is removed from the cast phenolic case by Krest Manufacturing Co. who also polishes the material to a high luster; the Insulation Manufacturing Co. molds the Bakelite housing. When the housings arrive at the plant of Electroaire Corp., the manufacturer, it is necessary only to tap holes for screws, then assemble the screen, switch panel and the electrical unit.

In choosing a material for this application the manufacturer first considered an enameled metal. However, the company felt that although this type of case might meet with approval for use in the kitchen, no metal, no matter how well finished, would be as acceptable as the plastic in a living room or in another part of the house. The plastic, besides being lighter in weight, has the advantage of coming in a number of attractive colors.

A smaller edition of giant units which for some time have been in operation in food storage plants, restaurants, theaters and public places where stale air is a menace to health and comfort, the ozone generator is a boon to the housewife in many ways.

The unit is said to work without motor, fans or moving parts, which so often break down, and to cause no annoying draft. It operates on 110 volts AC.

KEEPING up on one's correspondence has been made a pleasure with a five-piece Plexiglas desk set designed and fabricated by the Alpha Plastic Products Co. and distributed through quality stores. Its beauty lies in simplicity and the way the acrylic has been carefully beveled and polished so as to pick up light and bend it, creating an effect which cannot be duplicated by man-made decoration.

Of the five pieces, the rocker blotter is the most intricate. It is made in two parts—the rocker over which the blotter fits and the top that holds the rocker. The latter besides carrying a knob, has strips of acrylic cemented under each end. These strips are grooved in such a way as to hold the rocker. The company has a jig fashioned to the shape of the top piece so that when the operators wish to precision bend the acrylic sheet to the rocker shape they need only heat it, slip it in the jig and let it cool.

A two-pen stand is equipped with receivers to hold the pens upright and grooved so the pens may also rest horizontally. One-half inch posts are arranged and cemented at the ends to securely hold the perpetual calendar.

The injection-molded letter opener is purchased ready-made from a jobber. The letter container is simply constructed of acrylic sheets cemented to a base and the large blotter holder has two strips of the same material riveted into its base.

The fabricator credits the remarkable brilliance of this set to a specially mixed polishing agent and to the fact that beveling is done on the under side of the pieces rather than on the front, thus causing the maximum amount of light to be reflected.

PRODUCTS

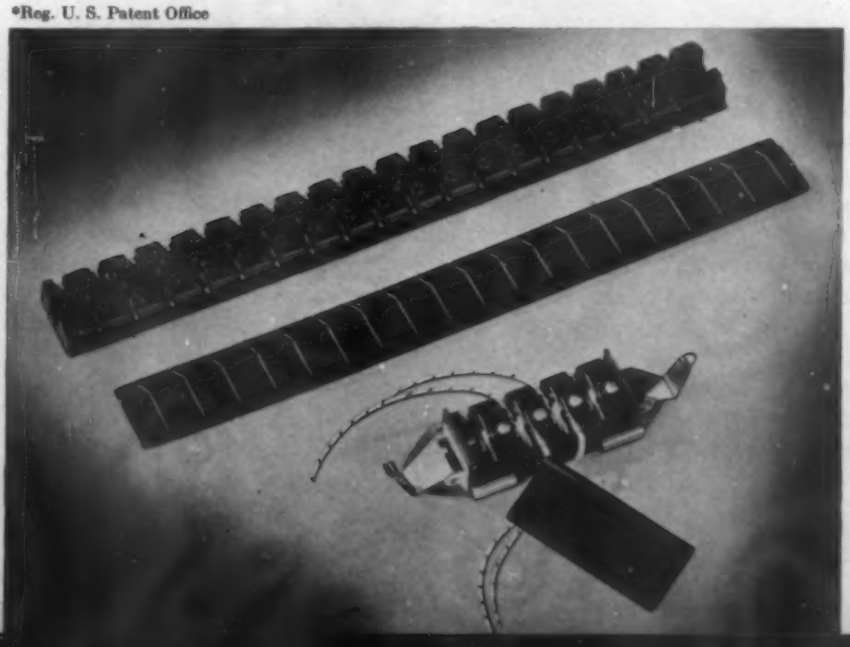
FOR locking and insulating electrical connections Aircraft-Marine Products, Inc., has produced a connector block molded of Bakelite in which ease of operation is a prime feature.

In developing the block, it was largely a matter of fitting the design to the material. Selection of a general purpose phenolic was made with an eye to the economy of that material as well as to its lightness and durability. The engineering design was then worked out so as to make the most of the characteristics of the phenolic. Electrical properties required by the block were kept in mind at all times. Owing to the intricacy of the many bosses and depressions, close precision work was required in the construction of the mold.

At first Kurz-Kasch, Inc., the molders, used a single compression-type mold, run in a 20-ton semi-automatic steam press, but as demand for the units increased, a program of setting up multiple cavity molds was started to produce blocks at a rate commensurate with its sales.

Connections are made easily by inserting a knife-disconnect terminal into a well formed in the block and pulling back on the wire. The conductor member is designed in such a way that a knife-disconnect end forms an integral part of it. By this means, the two terminals are connected within their own length and unnecessary parts are eliminated. A spring clip, which is part of the bracket for mounting the block, fastens the cover so that it cannot come off accidentally but can easily be removed for disconnection. The block is furnished in lengths ranging from 3 to 19 cells. By the use of shorting screws, any or all adjacent conductor members may be electrically connected.

*Reg. U. S. Patent Office



A STORE WITH A SPECIALTY

1—*This studio, which combines a retail outlet with a rear workshop, has built its success on the use of one material—methyl methacrylate—as the basis for all its varied products*

PERHAPS one of the greatest tributes to the versatility of plastics is that gift stores have been able to build up flourishing businesses featuring these materials. One California studio which designs, fabricates and sells has even gone a step further. It uses no other plastics but acrylics for the many varied small giftware items that it produces.

The tribute lies in the word *varied*. Stores of this type must have gifts and novelties that appeal to every taste, that are appropriate to every occasion and that fit every pocketbook. These are difficult conditions to meet even when there is no limitation on the materials that may be used. Yet Austin Suders and his business partner, Romona Frost, have been able to do it all using Lucite and Plexiglas as the base material sometimes in combination with another material. The studio also produces and sells larger gift items and home accessories made from various plastic laminates complemented by wood or aluminum.

Mr. Suders had a number of reasons for using acrylics for smaller items. Most important was his feeling that an expert knowledge of properties is necessary if a material is to be used to full advantage. And familiarity is most frequently the result of intensified specialization.

Then there is the versatility of acrylics. It lends itself to many varieties of decorative treatment; combines well with other materials; is readily machined, shaped and dyed; possesses good light refraction characteristics. In addition it has a modern look.

Variety in giftware

Results have fully justified this single material theory both as to variety and quality. A glimpse through the shop window (Fig. 1) shows shelves and stands crowded with jewelry, vases, boxes, toilet accessories, tableware. There is a delicate silver necklace strung with a handful of multi-colored acrylic stars. Small cube-shaped methyl methacrylate blocks, dyed soft rose, gold and amethyst, are suspended on a fine chain to form a unique part of earrings. There are evening bags laced with ribbon, clips whose jewel-like tints and hand-polished edges give them a reasonable resemblance to cut stones. Several hats—one a flat pillbox type of clear acrylic—were designed for Hollywood stars.

Special consideration has been given to the designing of giftware for men. Humidors and cigarette boxes achieve their clear-cut lines through a combination of crystal plastic sheet and sheet dyed ebony, deep garnet or mahogany. Or these boxes can be made like those in Fig. 2 of methyl methacrylate and a second material, either silver or gold being used as a decoration on the top of the box and for the ball-like feet. In this case the plastic is black and the contrast between it and the gold or silver feet and decorative cover knob strikes a luxury note. Pipe racks in deep colors are embellished with set-in strips of the clear material. The plastic clamps that hold the pipes are designed to keep them firmly in place.

Other gift items fabricated and merchandised by the Dorian store include ice buckets and tongs, salad bowls, vases and cake plates and trays that are decorated by nothing more than a formal grouping of stars or a flying Pegasus painted on the surface of the plastic sheet. Eagles designed in the modern manner or abstract forms (Fig. 3) make graceful as well as practical bookends. Torchéres, which are completely uncluttered rectangular forms, use methyl methacrylate with either a clear or a frosted surface.

A workshop behind the store

The actual production of these plastic articles is carried on in a small workshop at the rear of the store. Assembling is done on the simplest type jigs, and all polishing is a matter of hand work, each piece receiving the attention associated with custom-made articles.

The trial-and-error method is never employed in this studio. Rather than risk wasting material, Mr. Suders first works out his problems on paper, finding that this procedure gives the best results.

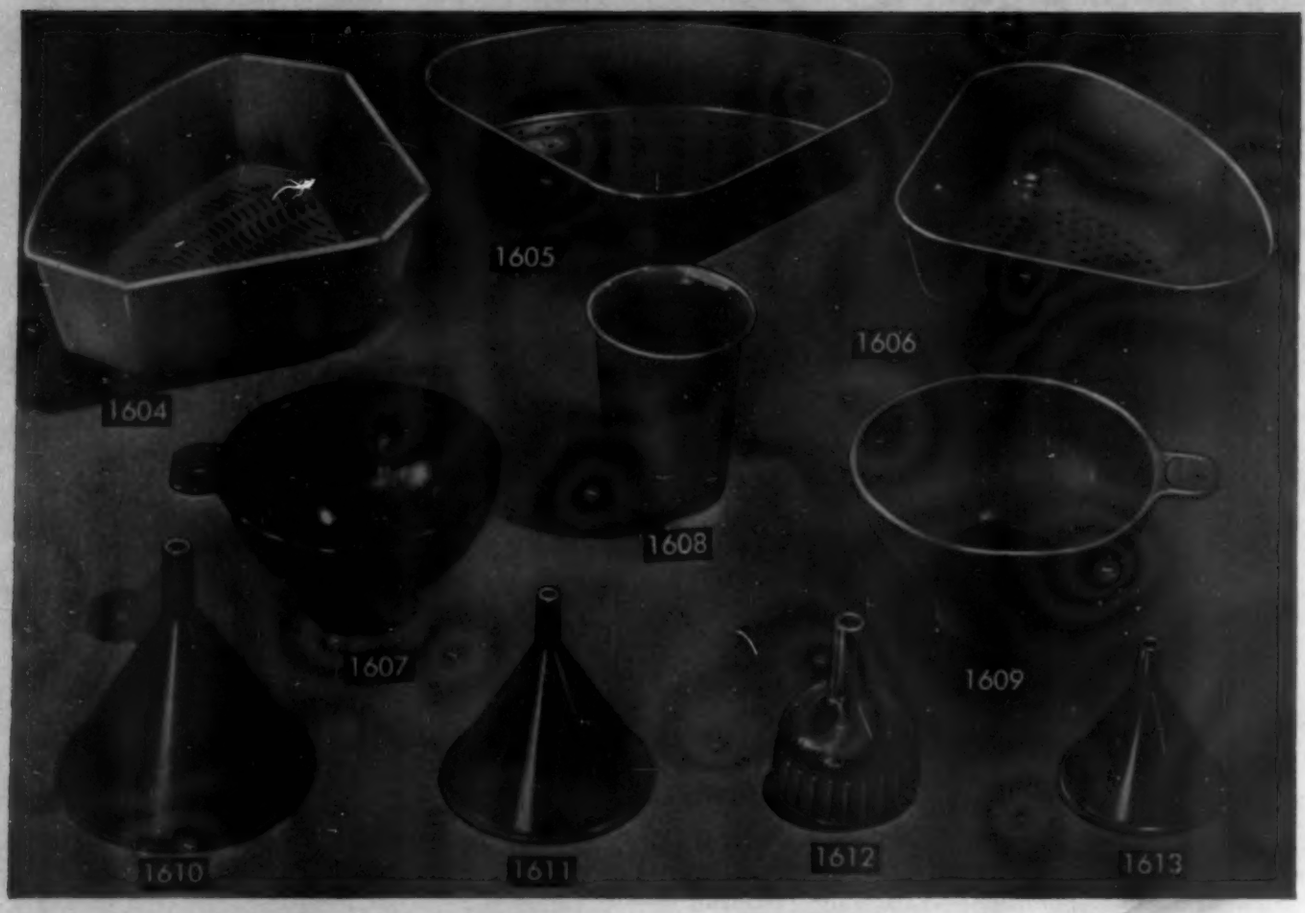
Not all the articles made in the workshop find their way to the front shop. The partners devote a part of their time to the designing of merchandise for other manufacturers. This is a phase of their activities which they plan to expand as materials become more available. And, finally, there is the special design work that they do for individuals seeking something out of the ordinary. Thus, a three-fold business has been built on the use of a single plastic material—for the smaller gifts and sometimes used in combination with other materials.

PHOTOS, COURTESY DORIAN STUDIOS

2

4

2—The mahogany-colored methacrylate bodies of this humidor and cigarette box are set off by the gold of the dolphins and the ball feet. 3—Clear and colored plastic sheets combine to form these modern bookends. 4—Methacrylate in every color of the rainbow appears in these earrings which have silver screw clips



Plastics Stock Molds*

SHEET ONE HUNDRED THIRTY-FIVE

Practical household accessories such as strainers, funnels, tumblers are made in assorted colors and are available from stock without mold cost. For names and addresses of manufacturers, write to Stock Mold Div., Modern Plastics, 122 E. 42nd St., New York 17, N. Y., giving item and sheet number

1604. Hexagonal sink strainer with slotted base. Overall dimensions: $8^1/_2$ in. by 7 in. by $2^1/_2$ in. deep

1605. Triangular sink strainer, molded of thermosetting material. Overall dimensions: $9^1/_4$ in. by $7^1/_4$ in. by 2 in. deep

1606. Triangular sink strainer. Overall dimensions: 9 in. by $6^3/_4$ in. by $2^1/_2$ in. deep

1607. Transparent bowl-type strainer, $5^3/_4$ in. diameter with 2-in. perforated opening

1608. Tumbler, $3^1/_2$ in. high; 3 in. in diameter at top tapering to 2 in. in diameter at bottom

1609. Bowl-type funnel, 6 in. in diameter with 2-in. opening

1610. Funnel, 8 oz. capacity. Diameter at top is 4 in. with $^3/_8$-in. opening. Molded of thermosetting material

1611. Funnel, 4 oz. capacity. Diameter at top is $3^1/_4$ in. with $^1/_4$-in. opening. Molded of thermosetting material

1612. Funnel, approximately 2 oz. capacity. $2^1/_2$ in. diameter at top with $^3/_8$-in. opening. Ridged edge for firm grip

1613. Funnel, 2 oz. capacity. Diameter is $2^1/_2$ in. at top with $^1/_4$-in. opening. Molded of thermosetting material

All molders and fabricators are invited to send samples of stock and proprietary items to appear on this page as space permits.

*Reg. U. S. Patent Office

Stock Items 1–1582 appear in Plastics Stock Mold Catalog, (1944, $5).

Plastics Engineering

F. B. STANLEY, Engineering Editor

Machining with diamond tools

According to this report to management, many finishing operations can be performed on plastic parts with no increase in costs, through the judicious use of diamond tools

by RICHARD MAXFIELD†

WOULDN'T it be helpful sometimes when a customer presents drawings for a molded plastic part in which, perhaps, one dimension calls for a tolerance of 0.001 in. to be able to assure him that we can easily hold this dimension and do it without greatly increasing the cost of the product? Well, within certain limits we can now safely offer just that.

The direct explanation is our adoption of diamond tools for the finishing of molded plastic articles. But, first, we had to get over the impression, too general among plastic processors, that a plastic part is taken from the mold, put in a package and sold. Once we accepted the idea that finishing is a basic part of our production and that its cost is an integral part of our final charge, it was possible to conceive of getting more out of this operation.

Take a part in which a shallow undercut on the I. D. is specified. Why not machine this groove at the same time that the flash and parting line are removed? Labor, perhaps the costliest factor in finishing, would be about the same. The difference would lie in the type of tools used. And this is where diamonds enter the picture—providing the long life that finishing tools must have if they are to do extra machine work.

A diamond tool is the same as any other cutting- or shearing-type tool except that a diamond, a real diamond and not a synthetic stone, forms the cutting head. The stone is shaped by having its outside contours cut down to flat facets on a diamond lap, a slow and painstaking process requiring a great deal of experience.

This shaped diamond is mounted in a steel shank to form a tool bit. The mounting process is secret and about all I can say is that the holder or shank is milled out to receive the stone. I believe silver solder is used to hold the diamond in place and the makers claim there is some actual adhesion to the stone itself. Diamond tool companies, like the Staset Co. which collaborates with us in the design of our tools, guarantee replacement of loose stones. The holder is finished to blend with the facets on the stone, and the equipment is ready for use.

This tool must not be confused with the more common type used for the truing of grinding wheels—an entirely different operation and one which requires an entirely different tool.

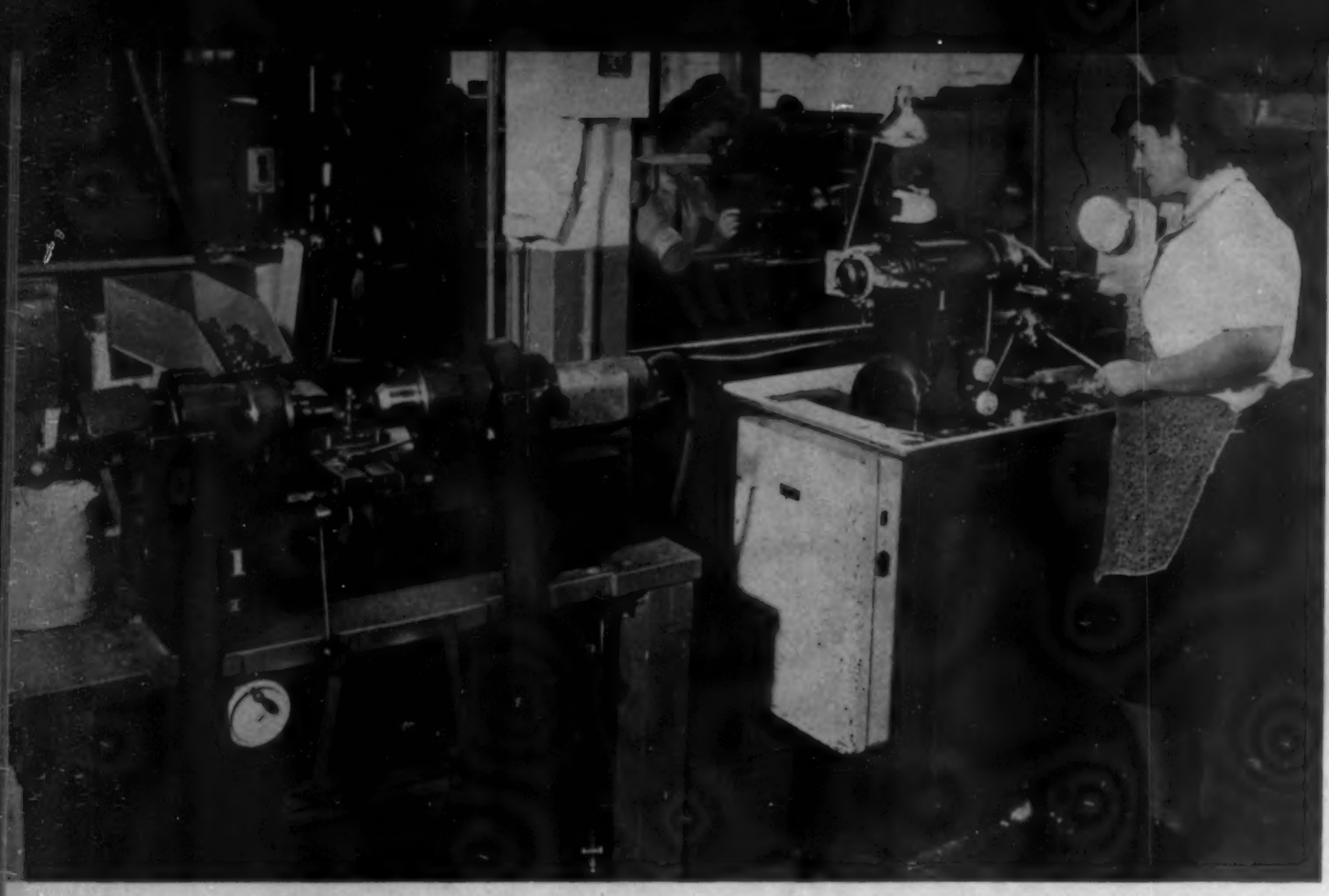
With a diamond tool we cannot have quite the same freedom of shaping to our cutting edge that we can with steel, or even with carboloy. While a diamond possesses very great tensile strength, it has very little impact strength and may be shattered by a sharp blow. For this reason, acute angles on the nose of the tools must be avoided.

We use many tools with included angles of 90° with a 0.020-in. radius as viewed from above. Another common tool has an 85° included angle and a radius of about 0.005 inch. This angle can be safely reduced to 70° and, if sufficient care is used, to 60°. In fact, it is possible to obtain a tool with no radius, but such a sharp point is easily damaged and is not recommended. Looking at the tool from the side, the top surface is

THE TIME TO USE DIAMOND TOOLS

1. **When production is high and machining is a necessary part of the finishing operations.**
2. **When a part *must* be machined and the specifications call for the very finest finish.**
3. **When more accurate dimensions are specified than can be obtained by molding.**
4. **When expensive mold construction can be avoided through the expedient of machining undercuts, grooves, etc.**
5. **When *anticipated* production warrants the slight additional cost of these tools.**

† Finishing engineer, Boonton Molding Co.
* Reg. U. S. Patent Office.



1—This view shows type of precision machines required to do accurate work with diamond tools. The machine carriages are operated manually and the parts to be cut are automatically clamped in place by air actuated pistons

usually placed in such a position that it is on a line radial from the center of the rotating piece.

Accuracy of dimensions with diamond tools

The advantages of diamond tools can perhaps best be explained by citing examples of the close and accurate work done with them. Let us suppose a part is 1.000 in. in diameter and must fit another part closely. Using diamond finishing tools we can supply that part with one outside diameter accurate to ±0.0002 inch. If the part is a cylinder or cup we can make the length accurate to the same tolerance.

"That's fine," you say. "But what about its dimensions one month from the time it is made?" The answer is, "It all depends on two major factors."

One consideration is, "How close do you want the part to remain to its original dimension?" If a deviation of 0.0015 in. is permissible, that is about what you may expect in 6 weeks' time. The deviation will, of course, be shrinkage.

The other major point relates to the fact that "plastics are affected by temperature and humidity to a much greater extent than are metals." In other words, if we make your part 1.000 in. in size on February 1st at 70° F. and 50 percent humidity, on March 15th at 70° F. and 50 percent humidity it will have shrunk to 0.9985 or 0.999 inch in size. After that it won't show much change if rechecked under the above conditions.

So what's the sense in holding a dimension to ±0.0002 if it will shrink 0.0015 inch? Well, suppose you want a precision lathe made to your order. Would you ask the manufacturer to cast the bed and head stock and carriage on February 1st, then machine all these parts to your specifications on February 2nd and deliver the machine on, say February 4th, just as soon as the paint is dry? Suppose he did do that, and on July 1st you wanted to machine some parts very accurately. You know the answer. The bed would be warped and the carriage would not slide smoothly.

The same thing holds on nearly all plastics, except that the aging period need not be as long. Roughly, the situation is something like this; if you want your parts close, we must wait 24 hr. after molding before we start any machining. I think we can assure you the part will then stay within 0.002 in. per in. from then on. *But*, if you want the ultimate in accuracy, 6 weeks are needed to age the parts before machining.

Bear in mind that all materials require aging periods when accuracy and stability are required. Wood must be dried, cast iron and steel must be aged and other materials, even glass, must be relieved of stresses. In some materials, the stabilizing or normalizing period may be hastened artificially. This may also be true of plastics and we propose to determine just what can be done along these lines.

I guess you have all heard that many of the parts we are now making are to be used for replacement stocks. This calls for unfailing interchangeability. I can conceive that we may, in the future, make two distinct

grades of parts. One will be a regular production part made to be used soon after delivery. For this piece we will conform to our 0.002 in. per in. standard. The second part will be known as a deluxe or grade "A" product, a stable, permanently accurate part. This product may be placed on the shelf with the assurance that it will be the same when you need it one year hence.

Of course you must realize the normalized part will be more expensive, mainly because more careful engineering planning will be required. It must be ordered farther in advance and blueprint changes are out.

Machined part versus the molded part

I believe that for practical purposes a good machined surface will be smoother than the average molded surface. A molded part might be better if the part is molded of a material specially selected to give good surface smoothness, *and* the mold is highly polished, *and* the cure, etc., are all correct. But fast, light buffing of a machined surface produces just as good results and assures truer dimensions.

The distortion that sometimes results from machining is due to the heat generated by most tools. Since diamond tools generate almost no heat, we can safely ignore this question.

As far as speed of production with diamond tools is concerned, the following examples are self-explanatory:

We had the job of turning out a small fragile ring-shaped part with an O. D. of about $^5/_8$ inch. It was an insulating ring for a magnetic compass. As molded the part had a horizontal flashing across the hole and on the O. D. Originally we hand-filled the hole with a pippin file and production was around 150 units per hour. Then the O. D. was machine-filed—an operation in which the production rate was 400 pieces per hour. Many parts were spoiled in hand-filing, many more broken in the course of the double handling.

We made a diamond tool set-up. The result was that a female operator in one handling could turn out 520 rings per hour. On a careful run to see just what

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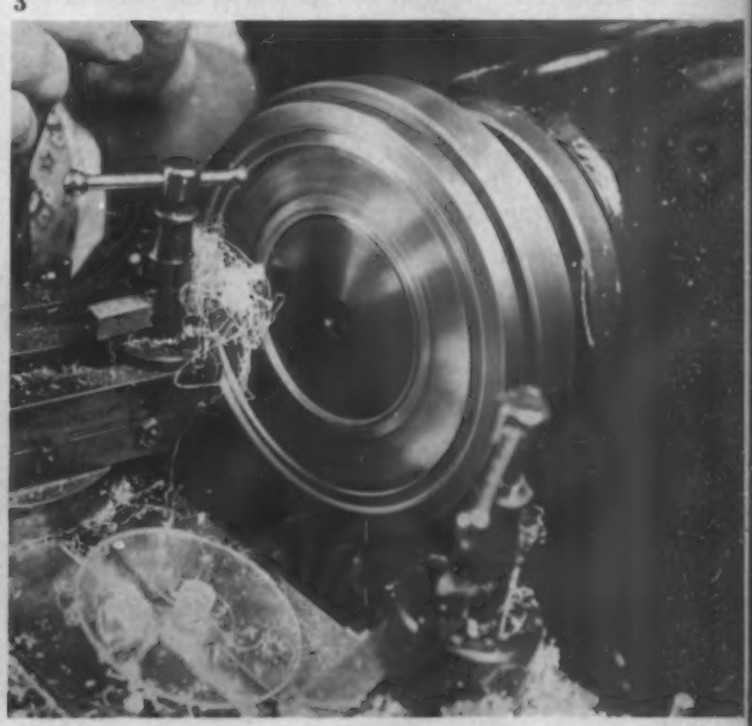

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2—To remove a center disk gate from a clock dial, a steel tool is first employed to rough cut it out of its place. Here the process is in progress and a previously cut disk lies on the table. 3—The diamond tool is then brought forward to finish out the edge to attain dimensional accuracy and give a high finish. 4—When the lathe is stopped, the clock dial is seen in its final form

PHOTOS ON PAGES 131 TO 134, COURTESY BOUNTON MOLDING CO.

5—Diamond tool on this machine is used to make an undercut in a thermoplastic part. The undercut can be made by the molding method but cutting is more feasible—being less expensive, more accurate and a faster process

we could do, we attained a production of 915 pieces per hour. On our latest run we turned out 225,000 pieces without resharpening. I should also mention that we were now able to hold a close I. D. dimension consistently with practically no rejects.

From the above, you can see that our cost per cut, the final criterion in judging a tool, is very low. In this connection it should be noted that diamond tooling operations must of necessity be mechanized and the work is accomplished by the movement of levers, handles, etc. This means that the operator with hand skill is released for other work.

Effect of machining on part strength

When we first started doing machine work on the outer surface of a phenolic part, we had a few misgivings. One of the most disturbing was the loss of strength which might be expected as the result of removing the surface resin. Recently, we obtained some interesting information on this loss of strength. We had a part molded of high strength material in which one of the requirements was high torque strength. Using both steel and diamond tools we made some grooves on the O. D. of a number of parts. A report on the reduction of strength due to machining shows:

Reduction in strength using steel tools—16 to 20 percent

Reduction in strength using diamond tools—8 percent

Since the diameter was reduced an equal amount in both cases, these observations are worth careful study. The groove was 0.187 in. wide, flat bottomed and with 60° sides. The only other way it could be produced would be through the use of a split mold. Now in a split molded part, the parting lines must be removed. This calls for scraping, filing and surface restoration operations that leave fine sharp tool marks. In a torque test, these marks are where breaks tend to occur. This is why parts machined with steel tools show a definite reduction in strength, greater than the loss in size warrants.

I think we can take this as a definite indication that the reduced strength of a machined part is not due to loss of surface but to the introduction of tool marks.

The kind of tool marks to which I refer are:

1. Those made by a tool that has a sharp V point so that the cut is actually a V thread.
2. Marks that are of such a nature that the material has a tendency to tear out or cause sharp grooves.

Either of these conditions will greatly weaken the part. Our cut must be made clearly and with a flat smooth surface. Only a diamond tool can satisfy this very necessary requirement.

Disadvantages of diamond tools

One of the prime disadvantages of machining is the loss of original molded finish. A machined finish may be better, but not the same. There is, for example, the question of the surface moisture resistance of molded versus machined surfaces. The machined surface will undoubtedly react to humidity changes more rapidly than the molded surface. However, if both surfaces are left in an atmosphere of changed humidity, they will finally reach the same condition of absorption.

Another disadvantage of diamond tools is their high initial cost. Further, they are easily broken and cannot be resharpened in the shop. Spares must, therefore, be carried in stock.

For very close work, we must use truly precision machines—*more* accurate machines than are needed for use with steel or carboloy tools. This is because a diamond tool will show up inaccuracies more conspicuously than do the other cutters.

The explanation lies in the fact that when a cut is made, the edge of the cutting tool is forced into the material. It is easy to see that two factors become very important at this point.

Leading edge—The leading edge of the tool must squeeze itself into a space surrounded by many other closely packed particles. The smaller the cutting edge

can be made, the less disturbance it creates in making its entrance. This all boils down to a keen cutting edge—and a diamond has the property of sharpening to a keener and smoother edge than any other material.

Smooth sides—The second factor is the smoothness of the sides of the tool, following the cutting edge. This is important, it controls the tool pressures that are required. If chips or shavings can slide smoothly off the tool, the generation of heat is kept to a minimum. Here again the diamond excels any other tool material.

And in addition to these two points of superiority, a diamond tool will resist nearly all forms of abrasion better than any other material. To us, this means that it will maintain a sharp cutting edge and a smooth chip land longer than other tools.

The importance of this point must not be underestimated. It is not just a matter of the cost per cut or of long runs without set-up time. It is much more than that. The real value is nowhere so great as in machining abrasive materials, where smooth finish is required. And it is because the first cut will be smooth, the second will be like the first, and so on and on. We have had production runs in which the 200,000th piece had the same smooth finish as the first. This may be better appreciated when you consider that the set-up had not been disturbed, the tool had not been adjusted. and no attention at all had been given to the operation.

Types of tools

When we first started, all of our tooling was made specially for the particular job. We did this purposely because we felt that it was proper to use what we considered the best method. Only after we had tried many types of operations did we begin to make studies of the tools. We found that there were certain features of every job that were similar and that many tools could be eliminated if the work was carefully planned.

We are now in the midst of a standardization of designs by which we hope to reduce our requirements for diamond tools to a comparatively few shapes and types. Just how far we can go in this matter is a question.

Recently we had settled on a particular type for thermoplastic materials. Along came nylon and we found that as the tool ended its cut, it rolled the material over. Finally we designed a tool which eliminated this rolling action, a tool that was found to work infinitely better on the other materials too, Lucite especially. Now this principle will be used on all tools for thermoplastic materials. Using these various types of heads and an easily fashioned tool-holding medium we have a flexibility that will again reduce our tooling costs for various plastic materials.

I suppose you wonder why you should be interested in our tooling costs. The answer is, that in the final analysis, the consumer pays for his tooling. If we can reduce this factor, the consumer saves.

Limitations of use of diamond tools

The foregoing is a general picture of a program, but many specific problems require special planning. And there are some limitations. For example, the removal of the surface material may affect the dielectric strength. And the finish will be slightly different than the mold finish. However close dimensions are usually necessary only where the piece must fit some other part, and here surface appearance is not important.

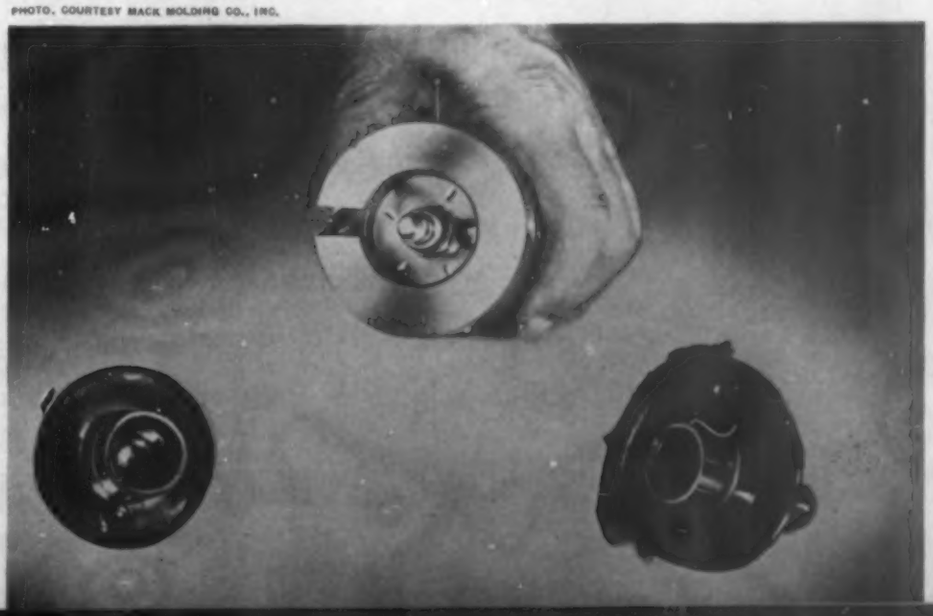
Diamond-cutting operations may not be practical where the production is low—a fact that is hard to determine on the basis of the data now available. However, in large production or where, for example, multiple-cavity round pieces are to be transfer molded, we can often maintain close dimensions and do so at lower costs than by our old methods. Where production is small, the increase in cost would only be for the cost of tooling. The actual production cost would usually be lower. In most instances, we shall be able to utilize some of our existing equipment and the costs on even small production runs should not be increased.

Conclusion

Diamond tools have an important place in the finishing of plastics. With proper care and use, they will outperform any other tooling material, and they will produce a finish at least comparable to an original molded surface.

However, they must be treated with respect. Many diamond performance tests have been complete failures because of improper care. If the user will observe the necessary precautions, he will have an instrument that will give him a product unequalled by any other method.

PHOTO, COURTESY MACK MOLDING CO., INC.



6—Ignition coil top is shown with flash (right) and with flash removed (left). In the center is seen a diamond tool used to remove bottom skirt and outside diameter flash from the part. Use of diamond tool about doubled lathing speed as compared with cutter formerly used

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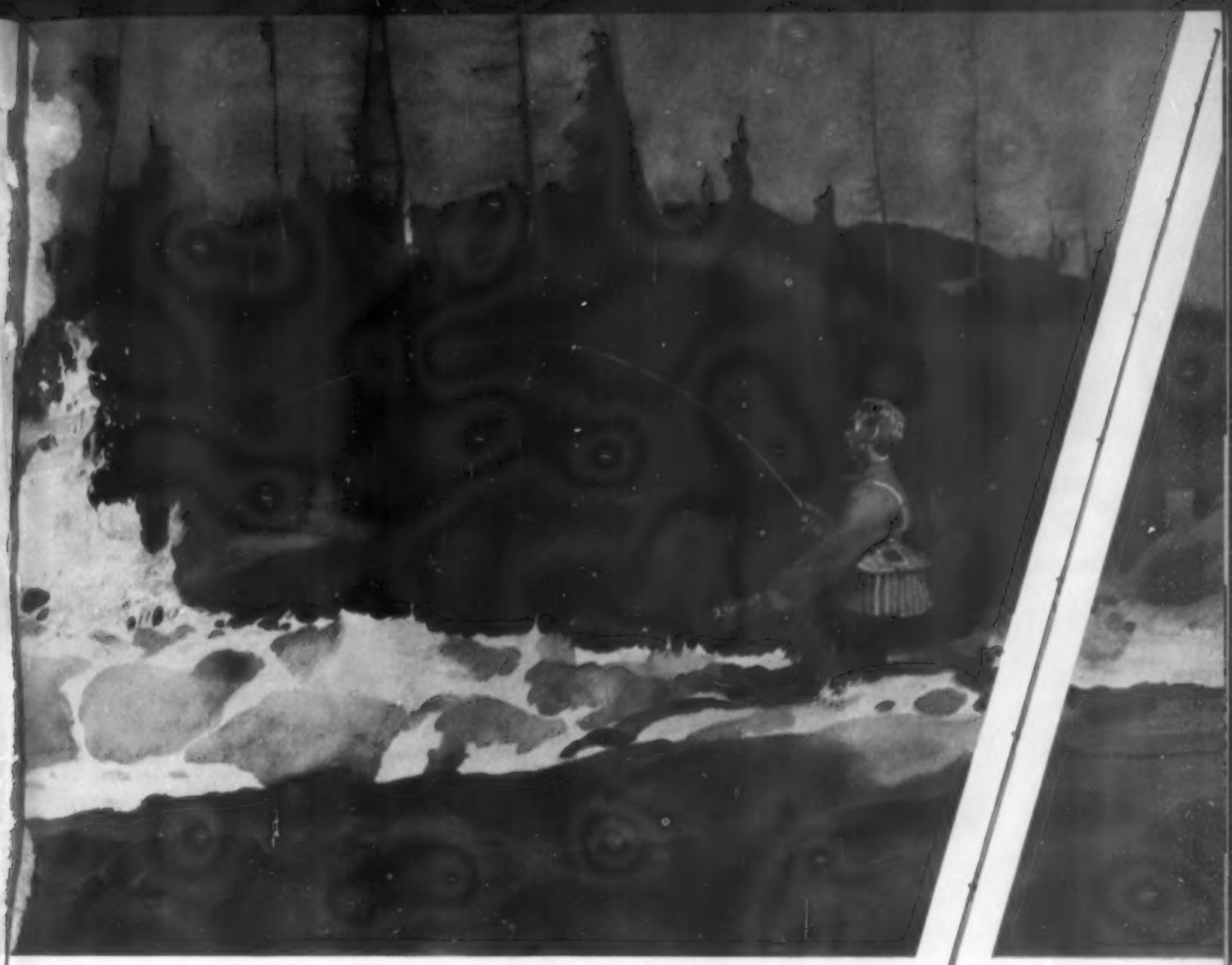

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Reinforcing low pressure moldings

by J. D. LINCOLN*

THE low pressure molding industry should really be called the low pressure reinforced plastics industry for its main contribution has been the reinforcing of plastics already in existence. In saying this, I will apologize to our friends who have done such a big job in methyl methacrylate, although with the coming of supersonic aircraft installations, I am sure they are going to be more interested in reinforcing. In some instances methacrylate windows have been strengthened at the edge by reinforcing material impregnated with low pressure resins which set at temperatures below the melting point of methacrylate. Bearing and attachment strengths have been developed in this manner which were greater than those of the piece itself.

During the war the principal reinforcing materials were several types of fiber—sisal proving the most practical when used in quantity without being woven into cloth. I believe postwar users will have a tendency to unweave the cloth and untwist the thread in the other types of fibers and in this way obtain better results and lower costs than we have in the past. Cotton is, at present, being used in oriented bats which exhibit remarkable high strength and are much lower in cost than is cotton woven in the form of cloth.

* Lincoln Industries, Inc.

ALL PHOTOS, COURTESY LINCOLN INDUSTRIES, INC.

Short fiber lengths as reinforcements

I firmly believe that our big brothers in the high pressure field could make good use of what we have been doing in the low pressure industry with chopped fibers of very short lengths. It is really remarkable how much increase in impact strength can be obtained by adding from 1 to 5 percent chopped fiber to any ordinary resin. The addition of these fibers would still leave high pressure people's resin fluid enough to flow properly in most high pressure processes.

To determine the lengths of these chopped fibers, we can borrow the thumb rule, length 20 times diameter, used by the reinforced concrete industry to develop full strength of their steel. By following this rule to develop the full length for our reinforcement and by using Fiberglas Double A type fiber, which has a diameter of approximately three one-hundred thousandth inches, the length of the strands would not need to be much over one thousandths of an inch. The addition of these fibers to ordinary resins will, I believe, give impact and tensile strengths many times higher than are possible at present, and there will be an increase in the stability of these materials over a much greater temperature range than exists when ordinary extenders or filler are used. There are many other fibers such as asbestos, which, as reinforcing agents, have lengths of little over one-fiftieth of an inch using this formula.

1 and 2—An aluminum shell mold (left) made of sections welded together. (Above) The completed shell is surrounded by a heating manifold and encased in concrete for greater strength. Here operators are laying up the impregnated material in the female mold

The carburetor intake scoop (Fig. 3) is a good example of one of the hardest pieces we have tried to make, using cloth as the reinforcing agent. While we believe this to be a success so far as performance is concerned, we do not consider the part to be practicable from a cost standpoint. The shape of the scoop is so complicated it was necessary to use a plaster mold which had to be destroyed to get each scoop out of the mold. In addition considerable hand labor was necessary to assemble and finish the job.

3—Because of the complicated contour of this carburetor intake scoop, the plaster mold used in its production had to be destroyed to get each scoop from the mold

Molds

We have used many types of molds in our work. The type we consider the most successful is an aluminum shell hand-hammered over a wooden block formed to the shape of the finished piece. Around this shell a steel tube manifold, or steel coil, is welded to conform to the mold contour, openings being left for steam entrance and condensate exit. The mold and manifold assembly are encased in reinforced concrete strong enough to carry the necessary pressure load on the female mold. After the concrete is cured, the inside of the aluminum shell is sanded and buffed to a smooth finish. This shell is treated with mold release compound before the laminate is laid in the mold. A rubber blanket is laid over the material before the lid is attached.

A second type of mold, used with limited success, is the cast iron shell which we cover with a 1-in. thick sheet of paraffin wax before encasing it in reinforced concrete. After the concrete sets, it is an easy matter to admit enough steam into the cast iron shell to heat it to a point where the paraffin will melt. When the liquid paraffin is drained out, a fairly good steam jacket is left between the reinforced concrete and the cast iron mold. This type of mold is much more durable than the aluminum shell but the time required to get a cast iron mold and finish it on the inside prohibits its use in many instances.

Low density core

In recent months sandwich idea structures that employ low density core material have become a very popular subject of research and study on the part of the industry. Many ideas have been brought forward for low density cores and the honeycomb method seems to be one of the best for achieving strength with low weight. I believe most of us have been doing this the hard way and have overlooked one of the oldest practices in fabrication—used by the Japanese prior to Pearl Harbor for Christmas bells.

Close examination of the construction of a Christmas bell, shows how it is made by applying parallel strips of glue, spaced about 1 in. apart, on a stack of paper sheets. The strips of glue are dodged so that the strip on every other sheet will come in between the strip of adjacent sheet. When a stack of paper is glued up in this manner, you can pull the two outside sheets and the complete structure will open up into

4—A study of the way in which paper Christmas bells are made suggests an easy method of constructing honeycomb reinforcing structures. Here a paper bell is compared with honeycomb (right) and expanded resin cores

what is almost a perfect honeycomb type structure. This stack can then be sawed up into widths corresponding to thickness of honeycomb needed.

Our company has just completed a 22-ft. speed boat molded with bottom, sides and decks all in one piece and with no ribs, using the honeycomb sandwich as the structural material. I am sure we could have saved quite a bit of our cost had we used the Christmas bell method of making honeycomb.

Now is probably the time for us to go back and consider some of the resins that would not work a couple of years ago and with these open an entirely new field to the low pressure plastic industry. I am referring to those resins which after being cured are still soft and pliable, and I am suggesting that we use this type of resin with suitable reinforcing materials to bui'd outdoor furniture such as hammocks which are commonly subjected to every type of weather.

Above all, I would recommend that we keep our plastic materials in the field where they belong, making a better product rather than trying to compete with stamped metal which has a field all to itself and a fabricating cost with which we cannot compete.

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For the first time, here is a shock-resistant, thermosetting plastic available in brilliant, permanent color. This color will help sell household appliances because housewives want brighter, more cheerful-looking kitchens and laundries.

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At the end of the war, to this same molding material, Cyanamid added *color* for consumer appeal! Today, many modern, practical products are being molded of this new MELMAC plastic. It is available in red, blue, green, ivory, white, brown, and black, for such applications as tableware, food trays, vacuum cleaner housings, refrigerator and stove parts, syrup dispensers, germicide containers, bottle warmers, and many new applications.

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Cyanamid Plastics

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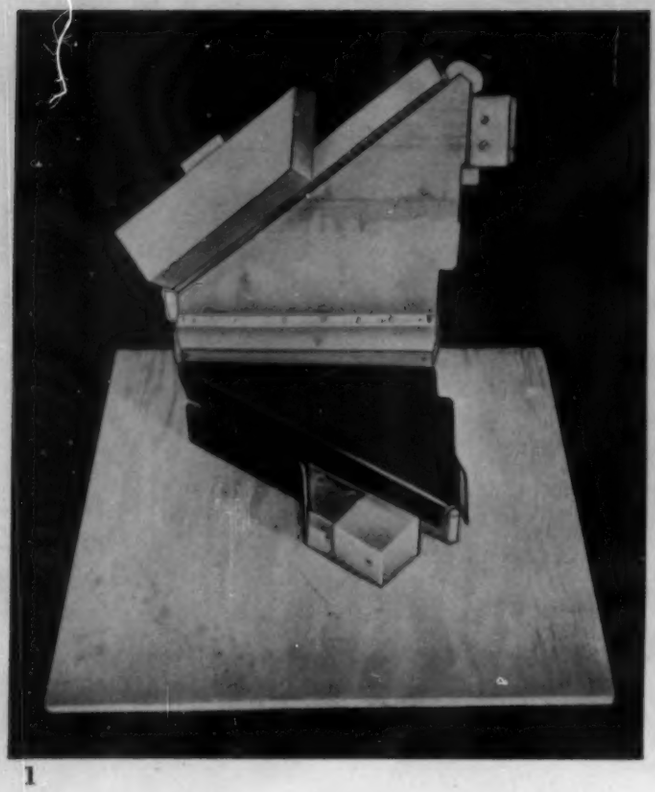

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1—This wooden forming die is called a book die because its opening and closing action is similar to that of a book. It permits an easy bending action on the material to be postformed without weakening fibers at bent portions. 2—The plunger type die with hinged sides produces the lamp bracket at the right

Postforming methods and applications*

by W. I. BEACH†

THE difference between postforming and other molding processes lies mainly in the treatment of the material. Postforming deals essentially with the physical deformation of crystalline amorphous or a combination amorphous and fiberous structure, depending upon the nature of the particular material that is to be worked.

Adaptation of postforming to aircraft parts

Although postforming is categorically classified as low pressure molding, it deviates from the conventional methods, largely in production technique. In practice, postforming has much in common with many of the metal fabricating operations. As in metal forming, the material—in this case, thermosetting laminated sheet stock—is stretched and deformed by externally applied forces. Dies and tools used in metal forming can often be switched over to the forming of plastic although this is seldom practical in view of the novel and unique die arrangements that have been devised specially for postforming.

This process is the direct outgrowth of the work done during the war to expedite the production of airplanes. Recognition that plastics had possibilities for playing a small but important part in the production of component parts came first. Means and ways for fabricating the material came second in importance and were therefore considered later.

Early work in postforming—Beginning in a modest way, small parts having postformed sections with simple bends were experimentally injected into the flow of aircraft parts intended for the various sub-assembly jigs and final assembly lines. Even these small parts having simple right angle bends in more than one direction introduced quite a number of problems in the beginning. These were solved by the construction of the book die (Fig. 1) which is typical of the type of

* Paper presented before S.P.I. Conference on Low Pressure Work held in Chicago on Feb. 1 and 2.
† Henry J. Kaiser Co.

tooling used in the early stages of the forming development. For reasons of cost, for ease of construction and particularly as a means of expediting tooling, wood was the principal material used in these dies. The fact that tooling could be made inexpensively and rapidly did much to encourage further interest in postforming methods and accelerate further research and development work.

Second step in the development of postforming—The next step in tool design led to the forming of simple compound bends and curves. The lamp bracket, shown in Fig. 2, is representative of the caliber of work demanded in this type of production. The plunger type die in Fig. 2 is one of the first to incorporate both hand and press operations. The force plug was attached to the ram of an arbor press; the sides were pushed up by hand and clamped in place with ordinary "C" clamps. Eventually, this work was accomplished automatically and in less time through the use of pneumatic presses. Cams were devised to press the sides together when the plunger forced the spring loaded die downward to a stationary base. A plastic dome light bracket (which is pictured beside the die) shows the beads and the angles that were drawn and formed at one time and in the same postforming operation.

More complicated contours—Later, with advancement in both forming technique and production tooling, more complicated parts were possible. Although wood had served well in experimental and temporary dies, more permanent forms consisting of kirksite, masonite, aluminum, laminated and cast plastics or a combination of several of the above materials were found more durable and to require less maintenance. Furthermore, it was found that with two- and three-stage dies designed to function automatically with air presses, some parts could be formed faster and at lower cost than comparable metal objects made with conventional metal working equipment.

In addition to the optimum reduction of cost and weight expected of formed laminated items other benefits are derived; namely, electrical and thermal insulation, resistance to abrasion and corrosion and reduction of motor noise transmission. Figure 3 shows a console part along with the forming die. The two base plates consist of fabric base laminated phenolic sheets. The formed part rests upon the lower matching plate which is made of cast phenolic. Directly above this is the upper matching plate. That portion of the die is also made of cast phenolic.

Deep drawn shapes

Just as improved technique and tooling were responsible for the forming of compound bends and curvatures, an equal amount of work was devoted to ways and means for obtaining deep drawn shapes. Attention is called to Figs, 4, 5 and 6, which depict the steps in the drawing of the upper ball turret housing used on a bomber airplane.

In Fig. 4, can be seen the flat sheet or blank of $^1/_8$-in. laminated material held in place by the steel plates. Above it, attached to the ram of an air cylinder, is a kirksite ball punch. The lower socket portion of the mold is also made from this material. Around the edges are fastened pressure cams which exert the necessary hold down pressure and prevent lateral wrinkles, developed as the material draws, from extending down

3—The male and female portions of this die are made of cast phenolic, each part being mounted on fabric-phenolic laminated base plate. The post formed part can be seen on the lower portion of the die

4

5

6

into the cavity of the formed part. Another view of the formed ball turret removed from the mold is presented in Fig. 5. Figure 6 gives a direct comparison of a blank, a drawn part and a part trimmed to finished dimensions.

Postforming adapted to postwar products

Due to the war, little, if any, time was devoted to experimenting with the application of postforming to civilian goods. Consequently, ventures in the direction of postwar uses have not been too plentiful. However, in a few instances some very remarkable work is being accomplished. Business considerations, however, have placed some limitations on what can be published regarding this activity.

Bread box—In the Northwest, a processor of plastics saw the possibilities of a formed laminated plastic bread box as a replacement for a plywood box. The box in use then was approximately 20 by 32 by 6 in. deep and held 24 loaves of bread. A formed plastic box, made from $^1/_{16}$ in. grade "C" laminated sheet, was placed in service for observation. A survey taken over a given period of time disclosed the fact that although the laminated box cost $8.00 as against $4.50 for the plywood box, its ton/miles shipping cost per year was $12.00 as compared to $27.00 for the old unit. The overall saving is obvious.

Deep freeze unit—An ingenious item now being produced in considerable quantity in Los Angeles is a deep freeze unit. Figure 7 shows several views of the formed plastic container. Designed to accompany the sportsman on fishing or hunting trips, this unit has ample capacity and refrigerating life to transport game or fish hundreds of miles at a temperature well under 0° F. Oval in shape, the outside dimensions of the freezer are 24 by 18 by 18 inches. The outside surface (Fig. 7) consists of formed laminated sheet material. All hardware is metal. Inside, spaced about 2 in. from the outer wall, is an aluminum container nested in a layer of Fiberglas insulation. Attached to the top is a perforated box which holds standard dry ice bricks. The drop from normal room temperature to −50° F. is accomplished in one hour. With 50 cents worth of dry ice (the capacity of the storage box) the temperature within the container will stay below 0° F. for 48 hours.

4—A ball turret housing is produced by a postforming die that has action similar to a drawing die. The steel pressure plate suspended from the male portion of the die holds the sheet of postforming material rigidity in position while the drawing action proceeds. 5—An operator holds the part after the drawing operation has been completed. 6—Three stages in the production of the ball turret housing. At the left is the die cut sheet of material; at the right is the drawn, unfinished housing. The completed part with excess material trimmed is in the center

This deep freeze container offers several advantages. The insulating properties of the laminate are superior to those of metal, so that it is unnecessary to provide breakers between the interior and exterior shells. Furthermore, the lid nests inside and is free to contact the metal, being an insulator itself. Lightness, resistance to denting and corrosion are other desirable features. In all, the deep freeze unit weighs 25 pounds. As far as is known, this is the only portable unit on the market that is designed for dry ice refrigeration.

Decorative applications—One of the most promising applications for postformed plastics is in the decorative field. Prior to World War II, decorative laminates were used to some extent as wall paneling in hotels and public buildings, and more generally as surfacing for table and bar tops. However, decorative sheet was usually restricted to flat surfaces. Cove bases and flanges, when used, were attached by chromium plated joining strips. Installation costs, plus the fact that some of the most attractive features of decorative patterns were frequently marred by attaching fixtures, was a disturbing factor. With the advent of formed decorative laminates, a newer and no doubt greater application of these materials is in the offing. Since most plastic decorative sheet materials are paper base laminates, considerable difficulty has been experienced in achieving the forming characteristics of woven fabric or mat filled laminates. However, right angle bends and slight draws may now be obtained. As a result of experimentation, one of the first items to be attempted was a sink top. This is a unit in which the flat area, cove base and edge flanges have been formed from a single sheet of decorative laminate. Although discussion on the above subject is limited and no illustrations are available, a complete kitchen unit has been assembled recently in which the sink, drainboard, service tables and various wall sections are entirely covered with formed decorative laminates.

Factors influencing future use

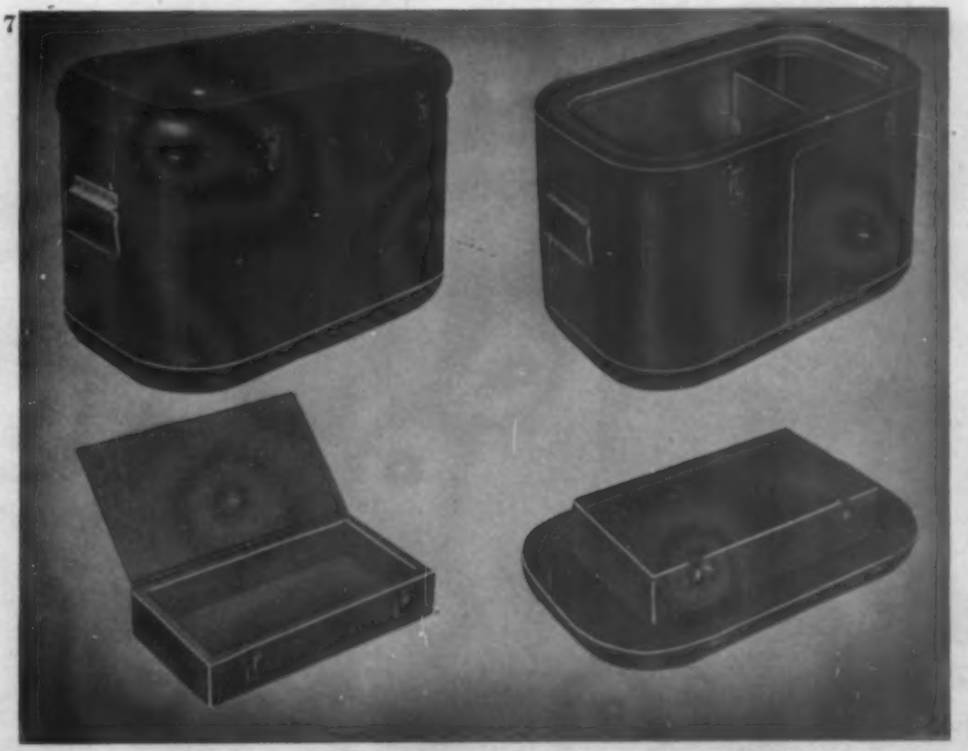
An evaluation of the possibilities for postforming for future applications depends upon public acceptance, economic factors, performance and utility. Due to the sparsity of civilian applications of postforming it is best to reserve judgment on what the future holds for this process. However, present trends in this work indicate that some important contributions to society may be forthcoming from postforming activities.

Electrical industry—The electrical industry consumes great quantities of laminated thermosetting sheet material in forms of power installations and household appliances. Already in many of these applications, formed plastics are being used or are in the process of planning.

Transportation—The transportation field furnishes a likely prospect for formed plastics. No doubt worthwhile applications will be made in automobiles, busses, trailers, boats and airplanes as a result of better strength-weight ratios and reduced costs of fabrication. For reasons already mentioned, formed plastics in many applications should be adapted admirably to the home.

A prospect which has potential implications is the forming of low pressure molded or laminated Fiberglas reinforced plastics. Recent successes indicate comparable formability to that of the fabric base products. With this development, structural materials are now available for postforming.

7



7—Two views of a deep freeze unit, the outside of which is of formed laminated sheet. An aluminum container is nested in a layer of glass fiber insulation. The perforated box at the lower left is used to hold dry ice. It is mounted on the inside of the freezer cover

High velocity simplifies band sawing

Introduction of improved saw bands and rigidly constructed high-speed machines has made possible a speed-up of operations with no loss in part finish or saw life

by H. J. CHAMBERLAND

SPEED limitations have long been regarded as a barrier to increased efficiency in band sawing. For this reason, the improved precision saw bands and rigidly constructed high-speed machines recently brought on the market, can be truly classed among the outstanding contributions to the art of fabricating. The combined operation of the precision saws and high-speed machines, has been credited with revolutionizing the cutting or shaping of more than 125 basic materials. As applied to plastics, the improved technique offers quite a number of advantages.

In order to band saw the general run of industrial plastics with any efficiency, even the maximum speed range of the standard contour sawing machine, which is 1500 f.p.m., is most inadequate. Yet, in the interest of saw life, it is often advisable to use relatively low speeds.

Now, with the introduction of the high-speed machine, a band saw may be operated at the precise speed recommended for the cutting of any particular plastic. In other words, the high-speed machine with its variable speed range of from 1000 to 5000 f.p.m takes over where the conventional machine leaves off. The Buttress type saw with its unique coarse pitch tooth provides a cool cutting tool particularly adapted to high velocity operation.

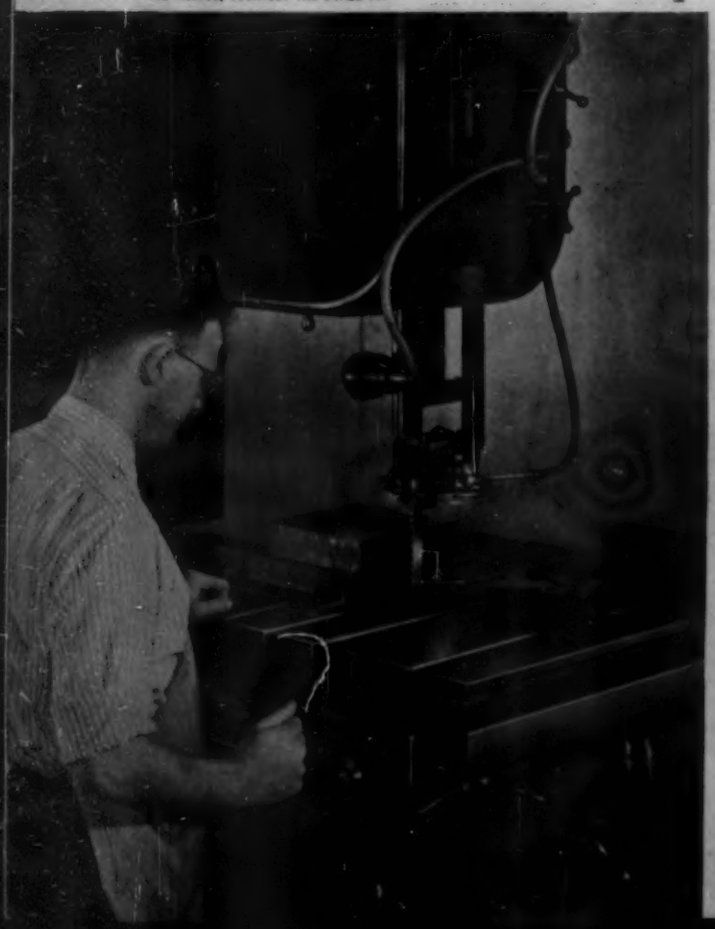
Plastics, like metals, cannot simply be band sawed. Each and every application requires the use of a sawing technique peculiarly its own. Thickness, hardness, whether the cut is straight or contoured, and the abrasiveness of the material are factors of importance in determining which saw to use and its velocity.

When mention is made of band sawing a certain type of plastic with the utmost or total efficiency, we refer to the highest cutting rate, highest type of finish and highest precision of cut consistent with a reasonable period of saw life. It is possible to markedly increase the cutting rate by sacrificing finish, saw life, or both. The decision as to what factor is most important—finish, saw life or speed—obviously governs the selection of the saw and its related velocity. In short, total

1—Automatic hydraulic feed is used in cutting this 4 in. thick high pressure laminate. 2—Acrylic sheets can be cut into intricate shapes speedily and with little effort with a Buttress saw

ALL PHOTOS, COURTESY THE DOALL CO.

1



2

3

4

3—Glass cloth laminate like this 12¼ by 12⅛ by 1½ in. piece is very abrasive. But 13 cuts were made in 23.94 min. with a ¾ in. 14 pitch saw at 400 f.p.m. 4—This canvas base phenolic contains aluminum oxide, is dense and usually hard to machine. Here a 2⅞ section is cut at 50 sq. in per min.

or partial efficiency is at hand, depending on requirements.

A study of Table I will show that speed recommendations vary from 1800 f.p.m. for a 6-in. thick molded phenolic part to 4600 f.p.m. for a 1/4-in. thick cast phenolic piece. Formulated and condensed from hundreds of laboratory tests and actual field practice, the table can be used as a guide whereby lost time will be cut down and saw life extended.

It must always be borne in mind that the high-speed technique does not and never will render conventional velocities and these standard pitch saws obsolete. Take, for example, the sawing of Fiberglas which has a cloth or felt base. These materials are highly abrasive and their band sawing somewhat resembles the cutting of natural glass, except for the problem of breakage. Experience indicates that for the materials of this type the saw must be properly heat treated, especially as regards the tooth hardness depth, or it will be shortlived.

Generally speaking, glass fiber materials cut very well with standard pitch saws 1/2 in. wide with a 0.042-in. Raker set. The pitch may vary from 10 to 24, the velocity depending on the thickness of material. A material thickness over 1/2 in. seems to require velocities under 400 f.p.m. However, the correct speed is easily established by starting with a low of approximately 150 f.p.m. and increasing the velocity until that point is reached which will give the desired cutting rate and finish with the least detrimental effect on the saw.

However, if the thickness of glass fiber materials is under 1/2 in., high-speed sawing will produce a faster cutting rate. Strangely enough, in this case the operation is not exactly one of *actual* sawing, but rather a combination of *actual* and *friction* sawing.

Friction sawing, in case the reader is not familiar with metal-cutting practice, is a process whereby the saw velocity is so high that sufficient heat is generated to soften the material coming in contact with the teeth.

Since Fiberglas is a comparatively softer material, the purpose of the combination process is to counteract the abrasive effects of the material on the saw and at the same time prevent disintegration of the fiber. This is clearly evidenced from the fact that whereas a velocity of 10,000 f.p.m. is necessary to friction saw 1/4-in. steel, a 1/4-in. thick piece of glass fiber with a cloth or felt base is cut most efficiently at 5000 f.p.m.

Table I.—Band Saw Pitch and Velocity Varied According to Type and Thickness of Plastic[a]

Materials	*Work thickness*							
	Saw pitch				*Saw velocity*			
	1/2	2	4	6	1/2	2	4	6
	in.	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
Methyl methacrylate	6	4	3	2	3600	2800	2500	2300
Cellulose acetate and butyrate	6	4	3	2	4200	3700	3500	3000
Phenolic (cast)	6	4	4	3	4600	4000	3500	3000
Phenolic laminate; paper and canvas base	6	4	4	3	4500	4300	4000	3500
Phenolic laminate, glass fabric and asbestos fillers	6	4	4	3	3900	3400	2800	2500
Polystyrene	6	4	4	3	4700	4500	4200	4000
Phenolic, molded; fabric and wood-flour filler	6	4	3	2	4400	3600	2700	2500
Phenolic, molded; macerated fabric, sisal, felt filler	6	4	4	2	3000	2500	1800	1800
Urea, molded	6	4	3	3	4700	4500	4200	4000
Vinyl resin	6	4	3	2	4700	4500	4200	4000

[a] Saw control factors are based on results with Do All high velocity contour sawing machine.

PHOTO COURTESY RESISTOFLEX CORP.

The steel grit often employed in sandblasting metal parts, such as these gun components, tends to wear away the metal surfaces of the sandblasting chamber. A solution to this problem was found in the use of compar as a lining for the cabinet and a covering for the wooden board used to hold the parts being sandblasted

Compar outlasts metal in sandblasting

HOW to sandblast metal parts without at the same time blasting away the walls of the sandblasting cabinet itself. This was the problem that faced the Ithaca Gun Co. when it undertook to manufacture .45 caliber automatic pistols for the United States Army. This was the problem that it solved through the use of Resistoflex compar.

Sandblasting dissolves metal pliers

Soon after the gun company started manufacture of these guns it found that sandblasting was one of the necessary operations. At first workmen tried to hold various small component parts of the guns in the path of the steel grit with pairs of pliers. But the steel particles, driven into the cabinet under about 100 lb. pressure, wore away the pliers within a few hours' time, leaving only the handles. In the same way, and in just as short a time, the perforated metal bottom and solid steel sides of the cabinet were cut to pieces.

After trying various expedients, the company covered a small wooden rack with a sheet of compar 20 by 20 by $^3/_4$ in. thick, cutting holes in the material the size of the component parts to be sandblasted. The metal gun parts were then fitted into these holes and the entire assembly placed in the sandblasting chamber. When the exposed sides of the metal parts were properly surfaced through the action of the steel grit, they were turned over and their other surfaces blasted. Even under continuous operation, the compar showed but slightly the effect upon its surface of the sandblasting operation.

Resurfacing entire inner surface

Having found a material that stood up well under the action of steel grit driven under 100 lb. pressure, the company undertook to surface all the inner walls of the cabinet with this compar. First a $^3/_8$-in. thick sheet of the vinyl compound was clamped to the bottom of the chamber, replacing perforated metal, which gave way too soon as the steel grit cut through the metal around the perforations. Experience has indicated that in this application compar lasts several times as long as $1^1/_2$-in. thick boiler plate, surprising as this may seem. The final step was to cement identical $^3/_8$-in. thick compar to the other inside surfaces of the sandblasting cabinet.

After these changes were made, the gun company was able to operate its sandblasting machines continuously for several months without being forced to stop for the replacement of interior metal surfaces. This contrasts with the early experience of the company, before using compar, when new metal surfacing had to be put inside the sandblasting cabinets as often as every few hours.

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Tenite-coated hand rail (the "RUB-BUB stanchion"), manufactured by Samuel Moore & Company, Kent, Ohio, from tubing coated by Carter Products Corp. of Cleveland.

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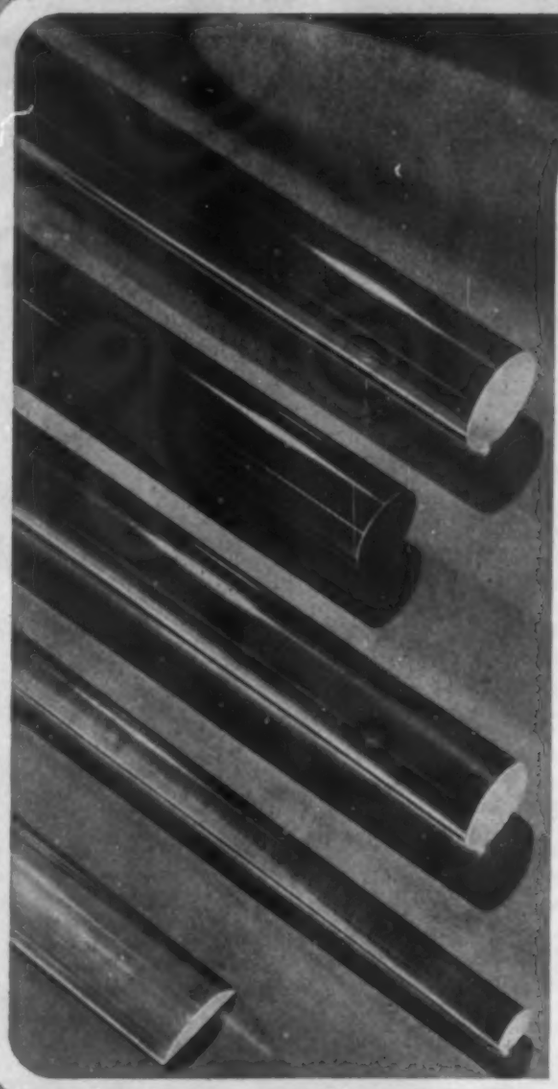

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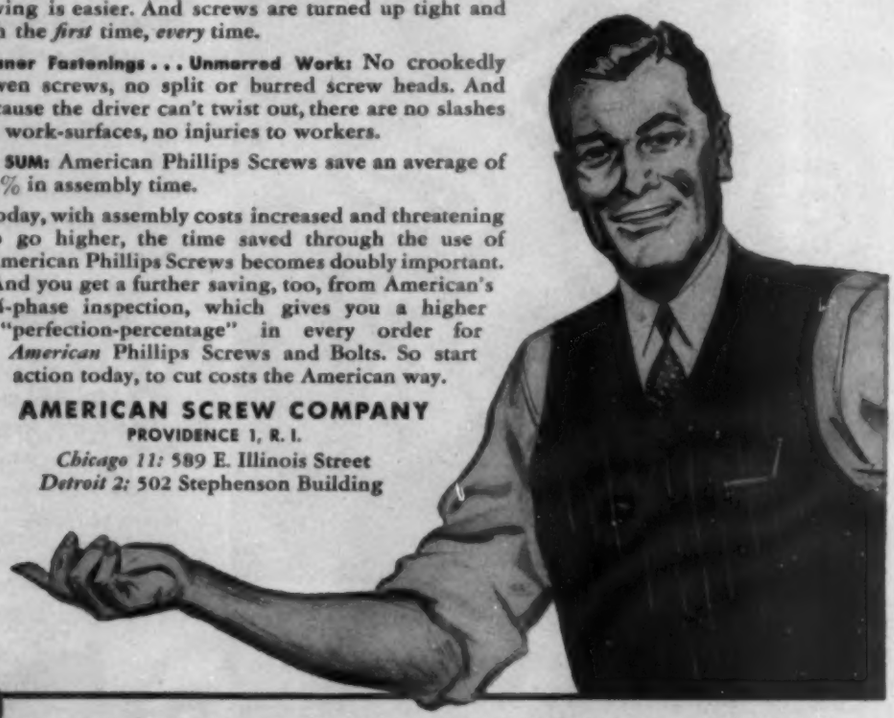

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Manufacture of compreg in Germany*

by R. RICHARDSON† and G. M. KLINE‡

RESIN-BONDED, compressed laminated wood made by Dynamit A.-G. at Troisdorf is known as Lignofol. The process was originated there by Samsanow in 1925–26, and the rate of production in 1943 reached 170 tons/mo. for the following uses:

	tons/mo.
Propellers	100
Aircraft dies, casters, bearing plates	50
Gears	10
Textile equipment	10

Propellers—The veneer is beech of 1.17 ± 0.04 mm. thickness. For propellers only the best quality of veneers, called first grade (Fig. 1), is suitable. The veneers to be used in the highly compressed portion of the blade must be straight grained and free from knots, checks or splits resulting from drying, and from other defects which might affect the strength of the blade. Splits which have developed during shipping and which will be closed during processing are permitted up to 10 cm. in length.

Small defects are permitted on those parts of the veneers which are to be used for the medium and low density parts of the blade. For example, tight knots up to a diameter of 10 mm. are allowable in the medium density part; loose knots of the same diameter and tight knots up to a diameter of 20 mm. are permissible in the low density part. No knurls are allowed on any of the veneers used for propellers. A small amount of 15° grain veneer needed for propellers was obtained from the veneer plant at a higher price.

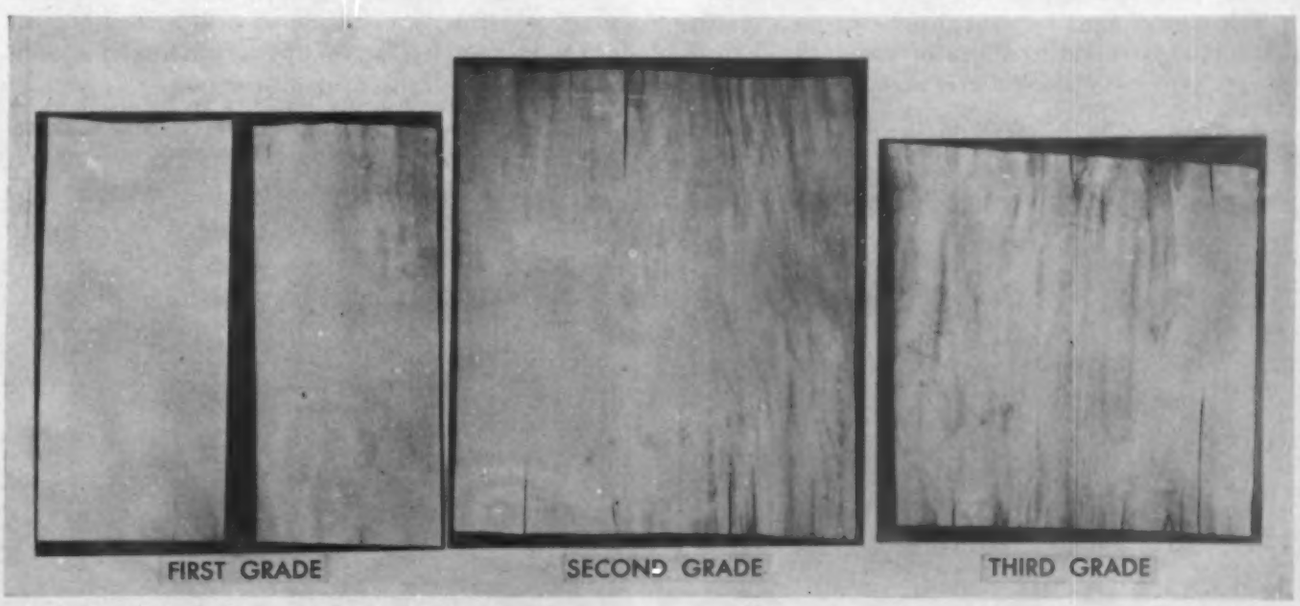
Gears—For gears, first and second grade veneers can be used. The second grade veneers may have very slight waviness of grain and may contain tight knots up to a diameter of 20 mm. and checks up to 350 mm. in length, but there cannot be more than two at an end. Veneers with 45° grain, used for gears, are prepared from small strips by edge gluing; hence imperfec-

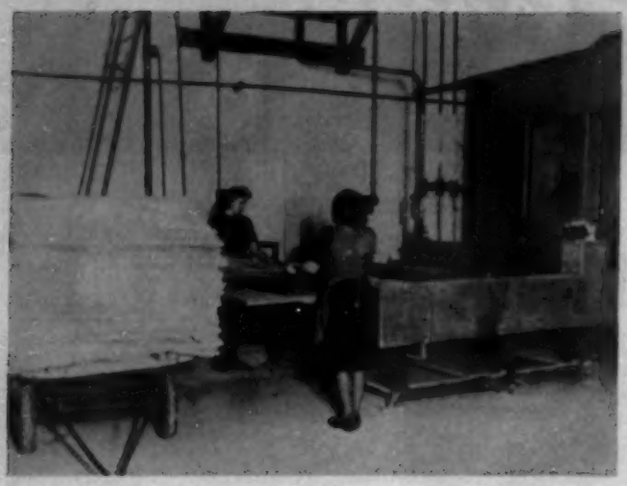
* Developments in the German plastics industry during the war have been thoroughly investigated by teams composed of technical representatives of the Ordnance Department, Quartermaster Corps, Chemical Warfare Service, Technical Industrial Intelligence Committee and other groups. The Department of Commerce is merely distributing this technical information which has come into its hands from captured German territory. This information should be made available to all United States citizens interested in it, but use of it by anyone must be and is at one's own risk in so far as the United States or foreign patent violations are concerned.

† Department of Reconstruction, Dominion of Canada.

‡ Chief, Plastics Section, National Bureau of Standards. The subject matter in this article was part of a paper presented by this author at the Annual Meeting of the Society of Plastics Engineers in Detroit on January 8, 1946.

1—*The three classifications into which beech veneer resin bonded compressed laminated wood is divided*





2—Lacquering machine for coating veneers with resin

tions can be trimmed from veneers used for this purpose.

Aircraft dies and textile equipment—For aircraft dies and textile equipment, second and third grade veneers can be used in equal proportions. Third grade veneers may contain tight knots of any size and number, but loose knots must not be over 80 mm. in diameter and there can be only four to a veneer. Splits may run halfway through veneer, but only three are allowed.

Moldy veneers are not acceptable under any circumstances. Streaks or discolorations resulting from the accumulation of resinous material are permitted if they do not decrease the strength. The tensile strength must be at least 800 kg./cm.^{2} (11,360 p.s.i.).

A log would yield about 10 percent of first grade veneer, 5 percent of second grade and 20 to 30 percent of third grade. The veneers are supplied in 1130 mm. (45 in.) lengths and 220 mm. (8.7 in.) and 440 mm. (17.3 in.) widths with about 10 percent moisture content. Veneer costs were stated to be 336 RM per cubic meter at the mill for first grade and 280 RM for third grade; the 15° grain veneers cost 373 RM per cubic meter.

The veneers must be somewhat larger than the finished pressed sheets to allow for trimming. Experience showed that 10 to 15 percent must be allowed for trimming of sheets 1 by 1 meter or larger, and that 25 percent must be allowed for smaller sheets, e.g., the 360 by 1030 mm. blocks made for propellers. Considering other veneer losses such as damage during shipment and factory waste, the Troisdorf plant used the following quantities of veneers per month:

	Veneers	
Use	*cu. meter*	*tons*
Propellers	240	168
Aircraft dies	90	63
Gears	27	19
Textile equipment	18	13

Resins

The adhesives used in making Lignofol are an alcohol-soluble cresol-formaldehyde resin, designated as T3S, and Tego film.

T3S resin—The composition of this resin is as follows:

Mixture I
- 1200 kg. cresol containing 50 percent *m*-cresol
- 960 kg. formaldehyde (30 percent)
- 60 kg. ammonia (25 percent)

140 kg. cresol containing 50 percent *m*-cresol
500 kg. alcohol

Mixture I is condensed for 80 min. at 80° C., then dehydrated by vacuum distillation at 50° C. until the resin in the kettle becomes clear. Then the second amount of cresol is added and well mixed by subsequent distillation for 5 minutes. Finally, the alcohol is added and the solution cooled to 20 to 25° C.

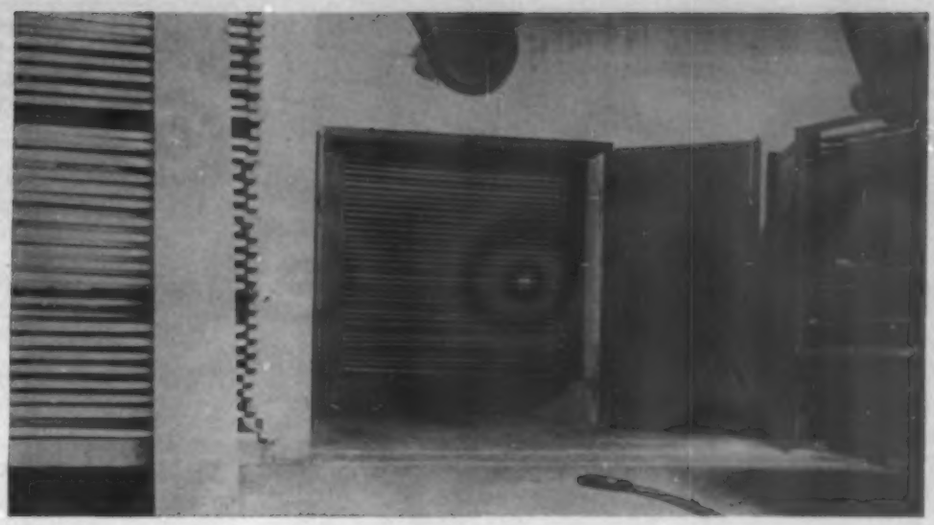
Average yield (based on cresol), %	156.4
Yield of solid resin, %	91
Loss on drying, % (90 min. at 150° C.)	ca. 41.6
Viscosity, cp.	200 to 250

Tego film—This film is manufactured by Th. Goldschmidt A.-G. The paper base weighs 20 g. per sq. meter and the resin coating 40 g. per sq. meter.

Both resins are insoluble in water. Samsanow observed that water-soluble resins penetrated the wood fibers and made them brittle. His objective was to use only sufficient resin to glue the surfaces of the fibers together. This is accomplished with a resin content of 3 to 4 percent in Lignofol. Some water-soluble resins

3—Loading end of machine for drying coated veneers

4—Dried veneers are unloaded at this end of machine



5—The conditioning room where the coated and uncoated veneers are kept at 25 to 28° C. with a relative humidity of 45 percent

have been employed in making Lignofol, but they require a longer drying time after veneers are coated.

In practice, about half of the Lignofol produced is made with the T3S resin and half with Tego film. The cost of the T3S resin was 5 pfg. and of Tego film 7 pfg. per sq. meter of veneer. The latter is used with third quality veneer which has a tendency to break when it is handled wet.

Manufacturing process

If the veneer is to be treated with T3S resin, it is immersed in the 35 percent alcoholic solution for a very short period and immediately run between the rolls of the lacquering machine (Fig. 2). A dyestuff is used in the resin solution so that complete coverage of the veneer can readily be checked. The dyestuff must be alcohol-soluble and destroyed at 150° C.; Diamond Green GX and Chrysoidin G are suitable. The solid resin content on each surface of the veneer must be 20 to 25 g. per sq. meter.

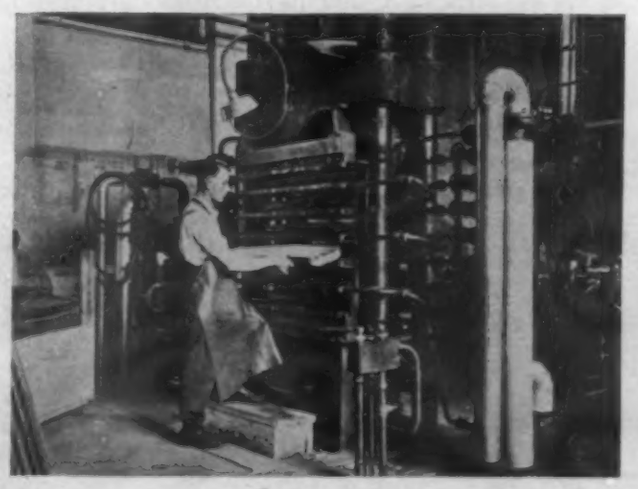
The coated veneer is passed through a drier (Figs. 3 and 4) to remove the alcohol, which is recovered. The drier is about 15 by 25 by 60 ft. in dimensions. Each veneer makes thirteen traverses of the 60 ft. length by a cascade belt arrangement. The drier operates at about 50° C. and the drying time is about $1^1/_2$ hours.

The coated veneers and the uncoated veneers to be used with them or with Tego film are stacked 6 ft. high on trucks with 1-in. separators between the layers and run into a conditioning room kept at 25 to 28° C. and 45 percent relative humidity. The capacity of this room is 33 trucks, each 4 by 6 ft., arranged in 3 rows. The trucks enter the room (Fig. 5) on one side through three entrances and are removed at the other side into a storage and assembly room.

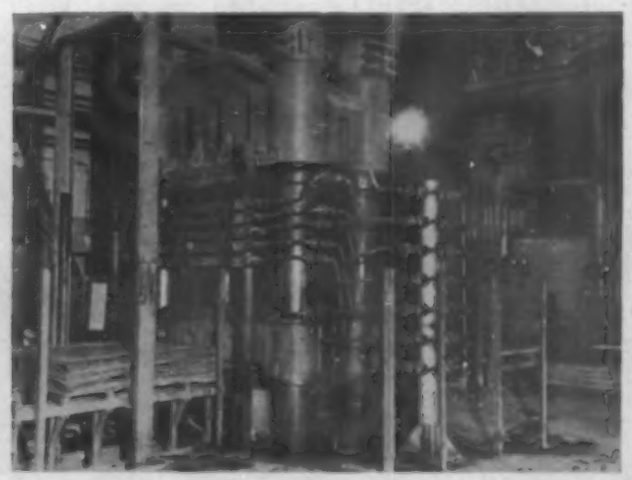
The moisture content of the veneer is about 10 percent on entering the conditioning room and 7 ± 0.5 percent on leaving it. The veneers are in the room about 4 hr. for the conditioning process; $1^1/_2$ hr. is considered to be sufficient and the additional time is allowed as a safeguard on quality. If the veneers are found to be too dry, they are steamed to a moisture content of 10 to 12 percent and reconditioned.

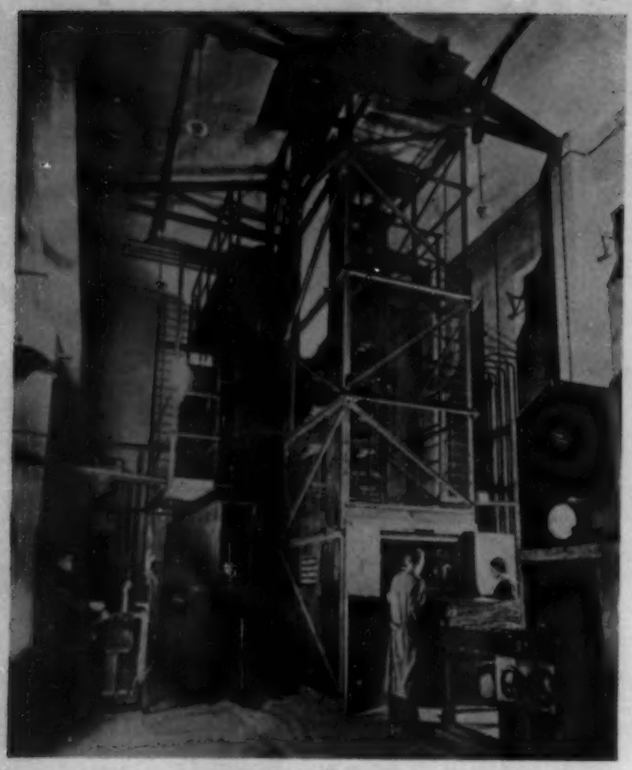
The assembly room is conditioned at 20° C. and 30

6—A 600-ton press used in making this laminated wood



7—Compressed wood can also be made in a 4000-ton press





8—A 2400-ton unit is yet another press used in this work

percent relative humidity. The manner in which the veneers are cut and laid up for pressing into sheets for the various end products will be described later. Six standard presses with platens 1.5 by 1 meter or 1.1 by 1 meter are used for the compression. Three of the presses are of 600 tons capacity (Fig. 6), one 2400 tons (Fig. 8) and two 4000 tons (Fig. 7). The 2400-ton press is unusual in that it was built with an extremely great stroke. The press stands about 30 ft. high with eight daylights and has loading and unloading elevators on each side of it. A cold press baler is connected to the loading elevator. This is the first press erected after the original experiments by Samsanow. It is designed to compress very thick boards up to 200 mm. (8 inches).

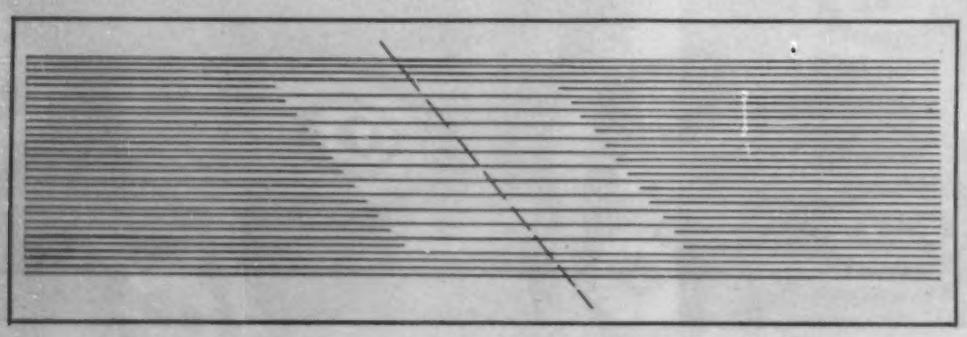
The pressure applied is 200 kg./cm.^{2} (2840 p.s.i.) and the temperature of the platens 150 to 170° C. The time of pressing varies with the thickness; 16 mm. board for propellers are heated for 30 min. at 160° C. and cooled to 30° C. by running cold water through the platens for 20 minutes; die stock of 90 mm. thickness requires heating for 4 hr. at 155° C. and cooling for 2$^1/_4$ hr. A low temperature and a long time are desired for best quality. Aluminum sheets dusted with talcum powder are used between the platens and the board, and steel spacer bars are used to control the thickness. For propeller stock these bars are preferably 1130 by 80 by 16 mm. to control the thickness to 16 ± 0.5 mm. The compression obtained is approximately 50 percent. The operating schedule for die stock is shown in Table I.

Propeller stock

A "double-pressed" Lignofol is prepared for the manufacture of Schwartz propellers. The name does not refer to the variable density of the material, but to the fact that two pieces suitable for blade making are cut from one pressed board. The tip of a Schwartz propeller blade is made of pine of 0.4 specific gravity; the hub end is Lignofol of 1.4 (standard) specific gravity to provide the strength needed in the threads. The Lignofol board is made up of nineteen straight-grain veneers of full length (1130 mm.) interlaid at each end with twelve 15° grain veneers of varying length (290 to 440 mm.). Thus the outer ends used for the 180 mm. square section of the hub have a specific gravity of 1.4, and then the board gradually reduces in specific gravity to 0.9 at the center. The board is cut diagonally through the variable density section to make two pieces suitable for scarf jointing to pine.

The 15° grain veneers are not coated with resin. After conditioning they are cut to the desired lengths and given a 35-mm. bevel at one end. The veneers are assembled on specially constructed tables on which they can be backed up on three sides. Four full length veneers are placed on the bottom and then the 15° grain veneers at each end are alternated with the full length veneers. Finally four full length veneers are placed on top of the assembly (Fig. 9). Care is taken in assembly of the straight-grain and 15° grain veneers that the cut side comes alternately to top and bottom.

In the 2400-ton press either eight assemblies 450 by 1130 mm. or sixteen assemblies 240 by 1130 mm. are pressed at one time. The three small 8-daylight presses of 600-ton capacity are also used to make the propeller stock. One man and two girls operate the presses on a continuous 1-hr. cycle schedule. Two blocks 1130 by 240 by 16 mm. are pressed in each daylight, using 250 tons per block or about 90 kg./cm.^{2} (1280 p.s.i.).



9—A diagram of the veneer assembly for making resin bonded compressed laminated board for propeller blades. The broken diagonal line indicates the direction of cutting board to make two scarfed pieces

Table I.—Pressing Schedule for Lignofol L-90

Thickness of board	Number of 1.17-mm. veneers	Pressing cycle: Heating time	Pressing cycle: Cooling time	Temperature
mm.		min.	min.	° C.
4	9	30	20	170
8	15	30	20	170
10	19	30	20	170
15	29	40	25	170
20	37	50	30	165
25	45	60	35	160
30	53	70	40	160
35	61	75	40	160
40	69	90	45	160
45	75	105	50	160
		hr.	hr.	
50	85	2	1	160
55	91	2	1 1/4	160
60	105	2 1/4	1 1/4	160
65	113	2 1/2	1 1/4	155
70	121	3	1 1/2	155
75	129	3 1/4	1 1/2	155
80	141	3 1/2	2	155
90	155	4	2 1/4	155
100	165	5 1/2	2 1/2	155
110	175	6	2 3/4	155
120	185	6 1/2	3	155

Aircraft dies and gear stock

The veneers used to make Lignofol for these applications are cut 10 mm. narrower than the platens of the presses. Second grade veneers are coated with resin and assembled alternately with uncoated third grade veneers. For die stock, known as Lignofol L90, the veneers are laid up cross grained (90°); for textile equipment nine veneers are laid up parallel and the tenth one at 45°. The veneer sides must be alternated for panels which are 20 mm. or less in thickness. The thicknesses of boards for these applications vary from 4 to 150 mm.

For this material the grain direction of the veneers is changed by 45° in every layer. The following procedure is used to make the 1000 mm. square veneers needed for these blocks: Take one strip 1500 by 500 mm. (or two strips 1500 by 250 mm.); add symmetrically on each side one strip 1000 by 250 mm. and then again one strip 500 by 250 mm. The assembly looks like a cross. Trim off the steplike edges and edge glue the pieces (Figs. 10 and 11).

All the veneers for gear stock are first or second grade and are coated with resin. The conditioning is the same as described for the propeller stock and the pressing schedule is identical with that shown in Table I for aircraft die stock. Gear stock is called Lignofol Z.

Inspection and properties

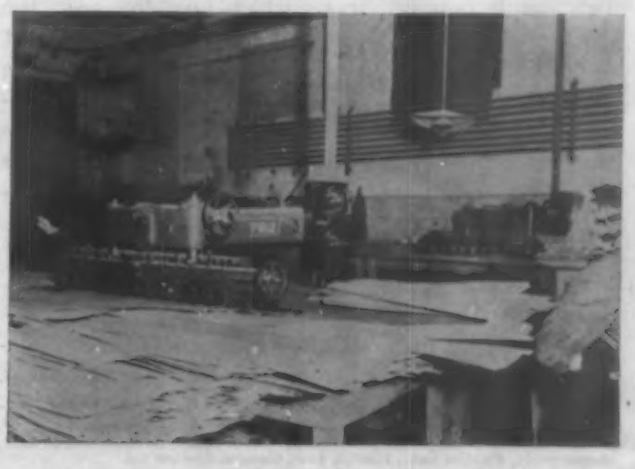
The pieces trimmed from the edges of every twentieth sheet of propeller stock are used for test purposes. The tensile strength is required to be not less than

10—*Machine for trimming veneer prior to edge gluing*

2400 kg./cm.² (34,080 p.s.i.); the product at Troisdorf averaged 2700 kg./cm.² (38,340 p.s.i.).

The following test requirements are applicable to all types of Lignofol. The absorption of water by test pieces 25 by 25 by 16 mm. kept in boiling water for 1 hr. is not permitted to exceed 5 percent; the Troisdorf material averaged 1.5 to 2.0 percent. The moisture content of the sheet is required to be between 6 and 9 percent. If the moisture content is less than 6 percent, the veneers will not have been compressed properly; if it exceeds 9 percent, the product will check on standing. The specific gravity is required to be at least 1.35 (at the hub ends only on propeller stock). The standard specific gravity is 1.4. A 3/4-in. wide trimming from every board is broken and examined for delamination. Impact tests are not made as a matter of routine since the process regularly produced high impact material, 45 to 50 cm.-kg./sq. cm. (approximately 10.4 to 11.5 ft.-lb./in. of width).

11—*The machine employed for edge gluing the veneers*



Silicone resin bonded laminates

L. V. LARSEN, J. J. WHELTON and J. J. PYLE*

Laminates of glass cloth bonded with silicone resin were exhibited to the public for the first time at the Detroit meeting of the Society of Plastics Engineers, January 7, 1946. The laminates, produced by the Plastics Div. of General Electric Co., are the result of years of study of the problem of adapting silicone resins to standard laminating practice. This newly announced application complements the previously commercialized uses for silicone products such as oils; greases; varnishes for coil impregnating, the preparation of pasted mica sheets and for high temperature paints; rubber-like materials; and moisture-repellent treatments. The silicone bonded laminates open up a new field of application as electrical insulation and for mechanical parts suited to operations at temperatures considerably above those laid down for conventional organic resins.

ALTHOUGH the silicone products are relatively new, the plastics industry is already familiar with the general nature of their composition as a result of the wide publicity given these materials. The common analogy is usually drawn between silicone resins and ordinary sand. This is valid for the resin in its final cured state, but a better appreciation of the nature and behavior of the silicon resins, particularly as applied to laminating, can be had by noting their similarity to phenolic resins during their process of condensation and cure.

A cured silicone resin has a structure similar to quartz or sand in that it comprises a network of interconnected chains of alternating silicon and oxygen atoms. However, each silicon atom in the resin bears one or two simple organic groups which give the resin the desirable properties that distinguish it from sand. It is possible to attach a variety of organic groups to the silicon atoms, either alkyl—such as methyl, ethyl, isopropyl, etc.— or aryl—such as phenyl, naphthyl, etc.— but either methyl or phenyl silicones, or combinations of these two, generally provide most if not all the properties desired for the usual commercial applications.

Preparing starting materials

Two general methods of preparing the starting materials for silicone resins are in commercial operation. Both make organosilicon halides. One uses the Grignard reaction by reacting an organic halide with magnesium, thence with silicon tetrachloride. The other works by reacting the organic halide directly with elementary silicon in the presence of a catalyst. The steps in the preparation of a methyl silicone resin are outlined below, using the direct process:

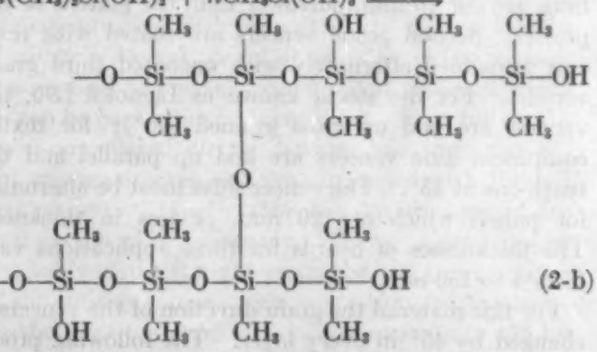
$$CH_3Cl + Si \rightarrow (CH_3)_3SiCl + (CH_3)_2SiCl_2 + CH_3SiCl_3 + SiCl_4 \quad (1)$$

The mixture of silicon chlorides is fractionated to give the individual compounds. The dichloride and the trichloride are mixed in a predetermined ratio and hydrolyzed with water:

$$m(CH_3)_2SiCl_2 + nCH_3SiCl_3 + H_2O \rightarrow m(CH_3)_2Si(OH)_2 + nCH_3Si(OH)_3 \quad (2\text{-a})$$

These hydroxy silicons, or silicols as they are called, are very reactive, and immediately on formation begin to condense with other silicols by the elimination of water. Relatively short chains of silicon-oxygen linkages are formed, still containing some uncondensed silicol groupings as follows:

$$m(CH_3)_2Si(OH)_2 + nCH_3Si(OH)_3 \xrightarrow{-H_2O}$$



(2-b)

As indicated here, the early condensations introduce few cross-linkages between linear chains. With phenyl silicones, the hydroxy silanes or silicols are even more stable towards this early condensation at the time of hydrolysis.

The molecular weight and proportion of unreacted hydroxyl groups are dependent on the specific conditions of the hydrolysis, but these factors are controllable to yield a low molecular weight silicone resin which is soluble in ordinary organic solvents such as toluene to produce a usable laminating varnish. The condition in reaction (2-b) may be thought of as analogous to the *B* stage of an alkaline catalyzed phenol-formaldehyde resin.

Using this silicone varnish in the conventional way, glass cloth or other suitable filler may be impregnated. The solvent is dried off and some further condensation of the silicol groups occurs so that the flow, squeeze-out

* Laminated development group leader, development chemist and director, respectively, Plastics Lab., Plastics Div., General Electric Co.

ALL PHOTOS, COURTESY PLASTICS DIV., GENERAL ELECTRIC CO.

One of the preliminary steps to be taken before the manufacture of the silicone bonded glass-cloth laminates is the impregnation of the fabric with the synthetic resin

or greenness, as it is variously called, of the impregnated stock can be regulated to the optimum required conditions. Finally, the impregnated sheets are stacked and laminated together under heat and pressure. The condensation of the resin proceeds to the final state of high molecular weight, insoluble, infusible cured resin, analogous to the *C* stage of the alkaline catalyzed phenol-formaldehyde resin. The tri-functional methyltrihydroxy silanes have entered into the condensed chain of dihydroxy silanes and have caused cross-linking of adjacent chains by condensation with other trihydroxy silanes.

Silicone resins can be made from dimethyldihydroxysilanes alone, but because only straight chains are possible the resulting resins are non-curing and thermoplastic. This condition is similar to the preparation of a resin from *o*-cresol and formaldehyde. While theoretically a very low concentration of tri-functional methyltrihydroxysilane is needed to co-condense with the difunctional compound to cause cross-linking, in practice a relatively large proportion of trihydroxy- to dihydroxysilane usually is employed to provide a reasonably fast cure.

As mentioned earlier, co-condensation of methyl silicols with phenyl silicols is possible, and the resulting resins are those of most interest in laminating.

Characteristics for laminating resin

A resin, whatever its composition, serves the laminator best if it possesses certain characteristics. For example, it should be readily soluble in some fairly low-boiling solvent to give a varnish of high solids concentration without excessively high viscosity. The behavior of the resin in drying on the filler stock and during the cure in the press is important. When heat is applied to the solvent-free resin it should melt down to a fluid of sufficiently high viscosity to remain in the laminated buildup without excessive squeeze-out. The further application of heat should result in an orderly increase in viscosity, resulting at the end of the cure cycle in a fluid of infinite viscosity, that is, a non-crystalline solid.

Many potentially thermosetting compositions of silicone resins fail to meet these requirements in one respect. In curing, they pass from a fluid melt to a gel without first reaching a high viscosity. A gel is a cross-linked structure which has some of the attributes of a thermoset or cured resin, but it cannot be made to melt and flow and is mechanically very weak. Hence, the formation of a gel in the early stage of cure in the press is very undesirable.

Effect of catalysts

Silicone resins can be so made that they will cure without this unwelcome gel formation, but usually the time required to cure is excessive. Many substances have been found which will accelerate the rate of cure, but the majority will cause the early formation of a gel and are, therefore, of little use. Substances which will

Silicone bonded glass-cloth laminates came into use during the war chiefly because of their high heat resistance.

accelerate the cure are such compounds as lead stearate, lead naphthenate, zinc chloride, ethyl borate, benzoyl peroxide and others. A limited number of these will shorten the time of cure without introducing other complications.

The effective concentrations of these various substances vary from as little as 0.001 percent to as high as 1 percent or more. For some reason the optimum catalyst concentration is quite critical in a very narrow range—too little catalyst causing no effect while too much may cause almost immediate gelling of the varnish.

Sometimes the effect of the catalyst may be misleading. If the degree of cure of a silicone resin is measured by the solubility in benzene and if a curve of benzene solubility *vs.* temperature is drawn both for a catalyzed and for an uncatalyzed resin, it is often found that the two resins reach the same ultimate degree of cure, but the temperature required for the uncatalyzed resin will be considerably higher than for the catalyzed resin. This makes the use of that catalyst seem desirable, but further study often shows that for the best physical properties of the laminate made from the resin, a high temperature must be used, whether a catalyst is present or not. Catalyst studies of that nature have led to the selection of one or two especially useful catalysts.

Effect of sizing on glass cloth

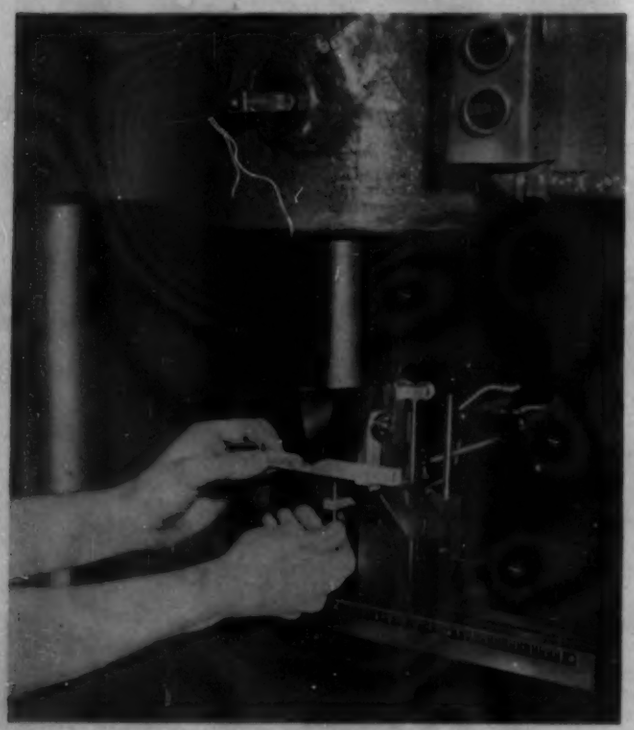
In order to take full advantage of the high heat endurance of the silicone resins an inorganic filler should be used. Glass cloth and mat, and asbestos cloth and paper are all usable, but at the present time the best silicone laminates are obtained from glass cloth. The ordinary sizing of glass cloth as received from the factory, which amounts to about 5 percent on the staple fiber cloth and about 3 percent on the continuous filament cloth and which is composed of an oil combined with starch, has presented quite a problem in the use of these cloths with silicone resins.

The presence of the original quantities of sizing on the cloth interfered considerably with the cure of the resins. Continuous filament cloth could not be used at all without desizing as the bonding strength of the laminate made from it was extremely low. The bonding strength of a laminate made from staple fiber cloth was, however, sufficiently high to merit further consideration. By heat treatment of the staple fiber cloth a large part of the sizing could be removed without causing excessive tendering of the fibers. The bonding strength of a laminate made from the heat-treated staple fiber cloth was higher, but the heat endurance was low. It was found that all the sizing must be removed from the glass cloth to prepare from it a laminate of satisfactory properties. This can be done either by washing the raw cloth in suitable detergents or by heat cleaning at 450° C. for a few hours.

Laminates made from this completely desized glass cloth have very good physical properties both as manufactured and after prolonged exposure to temperatures of 200 to 250° C. It was found that even traces of sizing left on glass cloth caused the electrical properties of laminates to deteriorate after water immersion.

Complete removal of the (*Please turn to page 192*)

Here a sample of the silicone glass-cloth laminate is being tested in a laboratory to determine its strength



Here sheets of the silicone resin impregnated glass cloth are being laminated together in a small laboratory press

Measuring heat distortion of plastics*

This improved automotive multi-unit apparatus for the measurement of the heat distortion of plastics was devised to minimize errors and correct disadvantages of present equipment

by G. LUBIN†

THE method used at present for measurement of the heat distortion temperature of plastic materials, as described in A.S.T.M. Designation D 648–44 T, has proved itself a satisfactory means of determining the thermal stability and estimating the maximum safe operating temperature of these materials. Essentially, the method involves determination of the temperature at which an arbitrary deformation (0.010 in.) of a rectangular bar of the material will occur when it is simply supported at both ends and is subjected to a concentrated central load so as to produce an arbitrary unit stress.

Reasons for new equipment

The apparatus described in this method and the one most widely used commercially, has several important drawbacks, and considerable attention has been given to its modification by various other investigators[1, 2] in attempts to eliminate some of its inherent deficiencies. Chief among these is the error caused by the component parts of the equipment for measurement of the deflection of the specimen which may be a combination of the excessive friction between the sliding weight and the supports, the non-rigidity of the whole apparatus and the thermal expansion of the specimen supports and other movable parts. The latter error may be considerable, where temperature rise is over 150° C.

In addition, the present form of the apparatus does not compensate for the pressure of the spring of the dial gage which may cause considerable error, especially in testing thin specimens. Other disadvantages of the present apparatus include the difficulty in changing the loading weight to allow for different thicknesses of materials, the small capacity of the unit and difficulty in manually controlling rate of temperature rise.

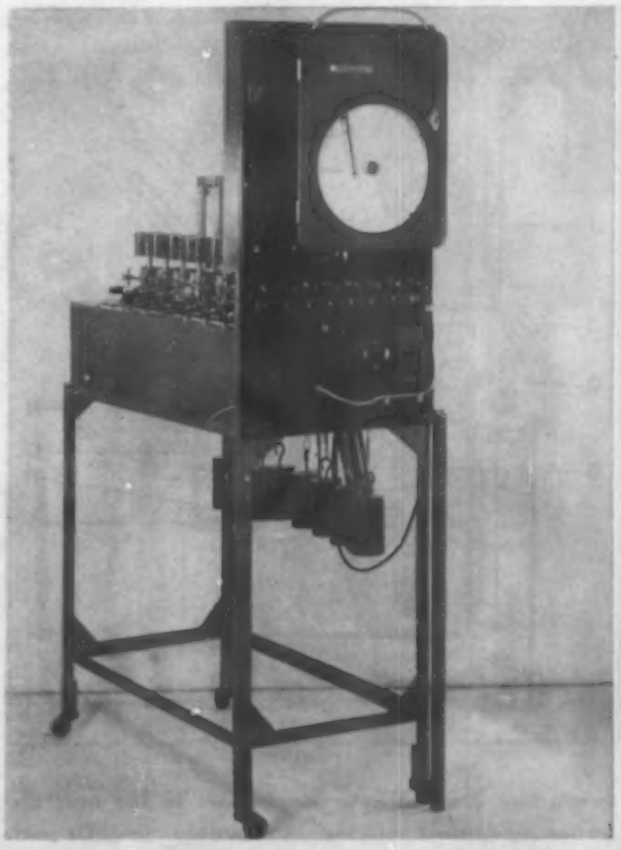
The apparatus described below was devised to minimize these errors and to correct the disadvantages of the present equipment but not to change the definition of the test nor to render obsolete the test data available.

The machine, as illustrated in Figs. 1 and 2, consists of 8 heat distortion units mounted in a common double-walled tank filled with a high-flash-point oil and insulated with 2 in. of glass wool. The inner wall of the tank is made of stainless steel to prevent corrosion and minimize contamination of the oil.

Description of improved apparatus

Each individual unit as shown in Figs. 3 and 4, consists of an Invar frame, *G*, mounted on a stainless steel plate, *N*. The specimen, *A*, rests on two $^1/_4$-in. diameter supports, *I*, 4 in. apart, with the load applied in the middle by means of a $^1/_8$-in. Invar rod, *B*. The tip of this rod is machined down to $^1/_4$ in. diameter and it slides through a pair of aligned bronze bushings. A micrometer, *D*, is attached by means of an arm, *O*, to the rod, *B*, and bears against a microswitch, *E*, which energizes an alarm and signal light. The dial of

1—*Heat distortion set-up showing program controller*



* The opinions or assertions contained herein are those of the writer, formerly Materials Engineer, Material Laboratory, Brooklyn Navy Yard, and are not to be construed as official or reflecting the views of the Navy Department or the Naval Service at large.

† York Research Corp.

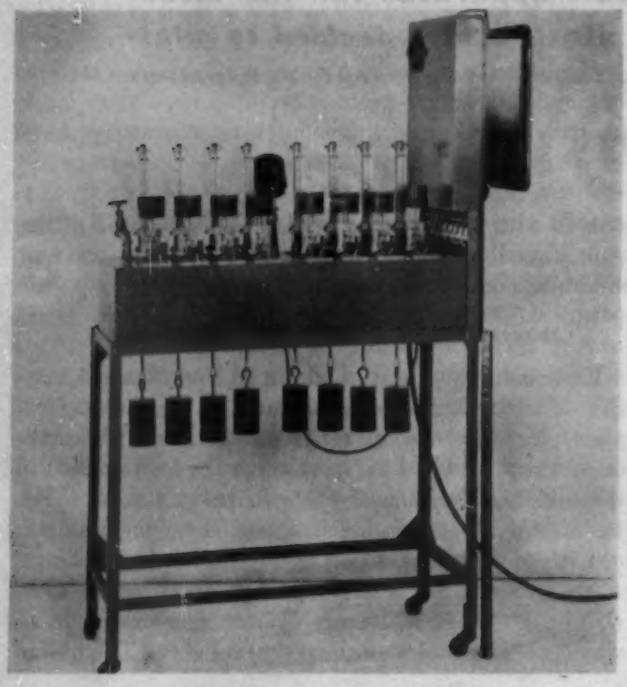
[1] "An improved method for determining heat distortion," by A. Eller, E. D. Liberti and D. H. Kallas, Plastics 2, 84 (Feb. 1945).

[2] "Relative temperature stability of stressed plastics," by J. A. Sauer, F. A. Schwertz and D. L. Worf, Modern Plastics 22, 153 (Mar. 1945).

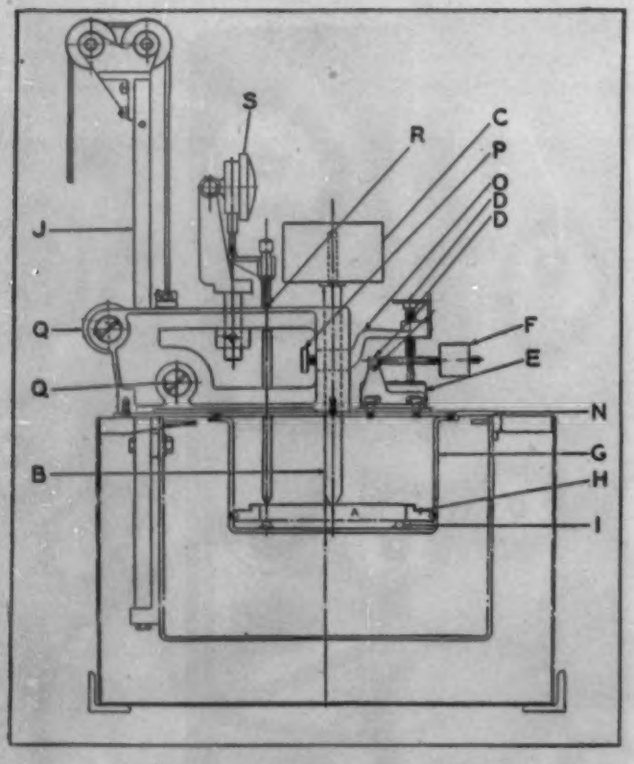
the micrometer is graduated in thousandths of an inch and the micrometer screw can be set accurately for a gap of from 0 to 1/2 inch. The total load on the specimen is the sum of the weights of the rod, the micrometer and the dead weight *C*. The microswitch does not add any appreciable load during the time of contact since it is made so it floats by the counter weight, *F*. The microswitch is operated through flexible, glass-covered leads, *K*. Each unit slides up and down on the support, *J*, and can be held in any position by means of a counter weight connected to each unit through the cord, *L*. The motion of the unit is made almost frictionless by means of the ball bearings, *Q*, and pulleys.

Also installed in the tank below the units are a stirrer motor (1/30 hp.), four 1000-watt calrod heaters and a seamless 1/2-in. iron pipe cooling coil. The temperature of the bath is regulated by means of the program controller shown in Fig. 1.

The controller operates in a normal manner through a relay and a vapor-filled bulb. The setting arm has a roller on the end and bears on a cam cut from a transparent plastic sheet mounted on the clock shaft of the controller. The cam moves the setting arm at the desired rate of temperature increase. The recording arm records the actual temperature of the bath, which usually does not vary more than one to two degrees from the temperature curve cut on the cam. The heaters are wired in a series—parallel in arrangement so that a smooth curve can be obtained for any temperature range with the proper combination of heaters. The three-position switch shown on the panel board controls the heaters.



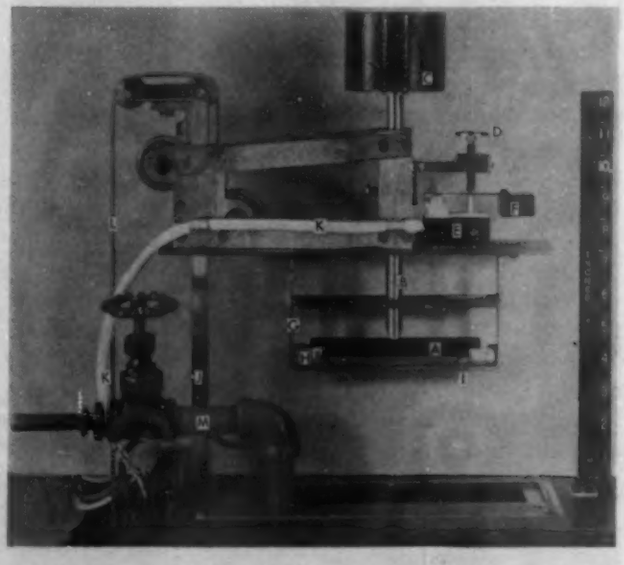
2—Front view of the 8-unit heat distortion apparatus



3—Outline drawing of a single unit in the heat distortion equipment showing an internal view of its parts

Procedure for making the test

To conduct the test, specimens are placed in each unit and the units are lowered into the bath. The weights to give the desired stress on the specimens are placed on each rod and the micrometers are screwed down slowly until the bulb on the panelboard corresponding to each unit is lighted. The micrometer dial of each unit is then moved back 10 divisions thus leaving a 0.010-in. space between (*Please turn to page 190*)



4—A close-up photograph of a single unit in the heat distortion apparatus. Parts are described in the text

Resistance of plastics to abrasive particles

by MAURICE E. MARKS and PAUL CONRAD*

WHEN plastics are used for glazing in aircraft, they are subjected to abrasion by high velocity particles. This marring of the surface is especially severe during take-offs from dirt or sand runways since large amounts of abrasive material are hurled at high velocity against the plastic windows by action of the propellers. Even when in flight some dust is always present so that at low altitudes, especially during landing, abrasive effects may be quite severe. Since none of the accepted standard methods cover the field of high velocity abrasive effects, it was considered important to design an apparatus and investigate the action of high velocity emery on representative materials. It was hoped that, after a number of variables had been investigated, a method could be developed which would be reproducible and serve a useful purpose for routine testing of plastics.

Abrasion tester

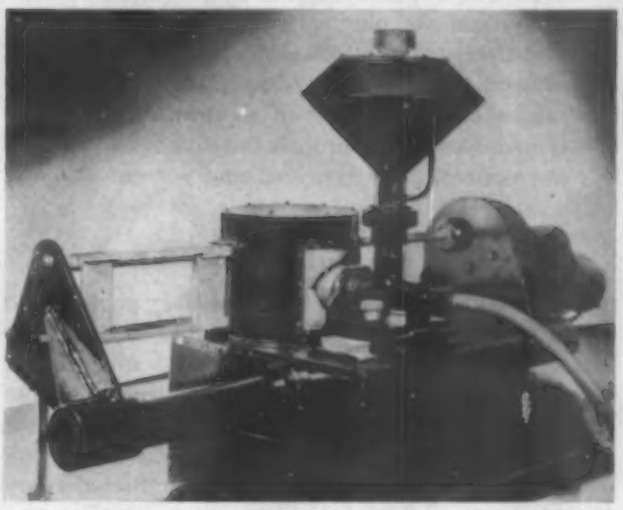
The abrasion comparator apparatus (Figs. 1 and 2) can be divided for ease of description according to the function of each portion.

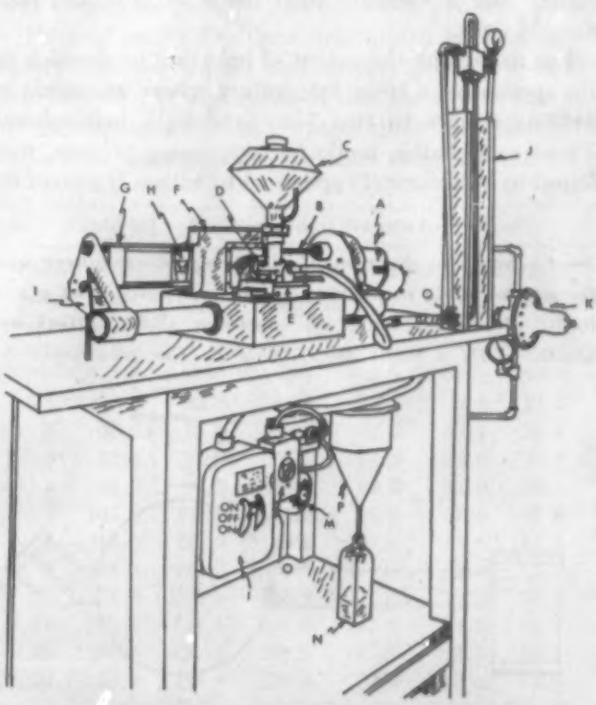
Air supply system—Air, taken from a high pressure line, is reduced by valve *K* (see Fig. 2) to the desired pressure before passing through the orifice meter *J*. The flow rate is then regulated by the setting of the valve *Q* in the line between the orifice meter and the blast chamber *F*. The air is introduced to the blast chamber through the mixing chamber *D* and the blast nozzle (not shown). In the mixing chamber a stream of emery is introduced at a controlled rate and the air stream is then passed through the nozzle where it is reduced to a $^1/_{16}$ by 1 in. vertical jet. Provision is made with the carriage *E* to adjust the angle of impact of the air jet on the sample up to 45° and to adjust the distance between the discharge of the nozzle and the face of the specimen. Scales are provided so that these settings can be duplicated.

Emery supply system—The emery, thoroughly dried, is placed in the hopper *C*. It is fed by gravity through an orifice into the mixing chamber, the size of the orifice determining the rate of feed. The small tube on the hopper equalizes the pressure on both sides of the orifice so the rate of emery feed will be independent of the air pressure in the mixing chamber.

Specimen feed—The sample is placed in the holder *G* and held in such a way that the face of the sample is in the same vertical plane regardless of the thickness of the specimen. The specimen is then drawn through the blast chamber by the screw *B* which engages a thread on the specimen holder. Power is provided by a Cenco stirrer motor and gear box *A*. Gears permit the variation of specimen travel speed between 62.4 and 0.42 in. per minute.

While not used in the experiments described in this paper, another variation can be made in the apparatus





1 and 2—A close-up view (above) and a drawing (below) of the abrasion comparator which is used in testing the resistance of different plastics to abrasive particles. The parts of the machine are described in the text at left

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by sliding the entire specimen carriage assembly through the base of the blast chamber support. This varies the distance the specimen carriage would move before the sample reaches the air jet. It was believed at the time of the original design that at a high specimen travel rate it might be necessary to allow for the time that it takes to bring the specimen up to the desired speed but this was not found necessary as the initial acceleration period is very short.

Electrical controls consist of a reversing switch *L* and two micro switches (not shown) at each end of the carriage. These are so wired that the specimen holder will move to one end of the carriage and stop until the switch is reversed, the holder then moving to the opposite end and stopping. In addition a switch *O* is provided to control the blower *M*.

The spent emery is removed from the bottom of the blast chamber by a current of air drawn through the blower and discharged through the cyclone to the outside atmosphere. The recovered emery drops into the bottle *N*.

Sphere for evaluating abrasive effects

The integrating sphere method for photometric measurements is fundamentally sound because the measurements are based on a constant quantity of light and are not dependent on the geometry of the optical system. In this method the light from the source is collimated and then passes into the sphere, where, with no light trap in place, it is reflected many times from the walls and thus integrated over the entire surface. The intensity at any part of the surface has a constant value and depends only on the intensity of the entering light, the diameter of the sphere and the reflectance factor of the surface paint. By using a light trap at the exit end, all the parallel light can be absorbed and a measure then made of only the non-parallel light.

For measuring the extent of haze due to abrasion on the specimens, a 10-in. integrating sphere was made by welding flanges to two 5-in. sand bath hemispheres. These sand baths, made by a spinning process, were found to be accurately spherical to within $^1/_{32}$ in. of the diameter. A highly reflecting white paint (approximately 96 percent white light transmission) was used to paint the inner surfaces. As shown in Fig. 3, a light source consisting of a 50-candle-power automobile bulb was set at the focal point *A* of a double convex lens *B*. The parallel light thus formed entered the sphere through a 1-in. opening *C*. Slides for the specimen, filters and a shutter were provided also at *C*. Another 1-in. hole was located directly opposite at *D*. This hole could either be covered with a portion of the sphere wall removed to make the hole, or could be covered with a light trap or with the specimen. The light trap was a black box in which a mirror was placed at a 45° angle in order to reflect the light into the box. The light intensity inside sphere was determined by measuring the light reflected to a photronic cell and galvanometer *E*.

3—A schematic diagram of the integrating sphere used for photometric measuring shows the placement of: A, bulb; B, convex lens; C, specimen slides, filters and shutter; D, a light trap; and E, the photronic cell

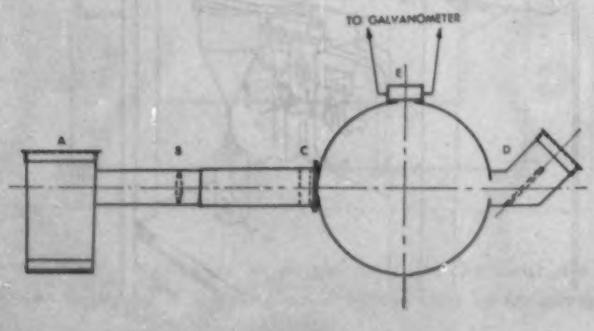


Table I.—Light Transmission with Integrating Sphere

Material	*Light transmission*
	Percent
Methacrylate I	92.0
CR 39-1	91.9
Methacrylate II	91.7

The abrasion on the specimens was evaluated in terms of the scattered light, i.e., the amount of diffusion of the parallel light incident on the specimen caused by the marred surface. Visual observations and data later to be given, indicated that the light scattered was proportional to the abrading action on the specimen.

The measurements were carried out by the following procedure. With the white disk in place at *D*, the light intensity at *E* was read without the specimen in place (Measurement 1). The specimen was then put in the holder at *C* and the decreased intensity read (Measurement 2). Then:

$$\text{Percent light transmission} = \frac{\text{Measurement 2}}{\text{Measurement 1}} \times 100$$

With the specimen still at *C*, the light trap was put in place of the white disk at *D* and the light intensity again read (Measurement 3). This gave a measure of the quantity of light scattered by the specimen. Then:

$$\text{Percent scattered light} = \frac{\text{Measurement 3}}{\text{Measurement 2}} \times 100$$

Reflection could also be measured with this instrument by comparison with a standard magnesium carbonate block. This block (97.5 percent total reflection) was placed at *D* and the light intensity measured (Measurement 4). The specimen was then placed at *D* and the measurement was repeated (Measurement 5). Then:

$$\text{Percent reflection} = \frac{\text{Measurement 5}}{\text{Measurement 4}} \times \frac{100}{0.975}$$

Measurements of light transmission on a number of $^1/_8$-in. thick pieces of plastic are shown in Table I. The light transmission agreed quite well with values

calculated from refractive indices (about 92.0 percent). There was no necessity for making corrections for multiple reflections of light, which is sometimes necessary in other types of instruments.

Measurements made with the integrating sphere of the diffusion caused by abraded specimens of CR 39-1 plastic were compared with measurements made by the standard method of the American Society for Testing Materials, A.S.T.M. D 672–42 T (Haze of transparent plastics by photoelectric cell). In the particular design of the A.S.T.M. method employed, a lens system described as above was used for obtaining parallel light. In Table II the data obtained by the two methods are compared. It will be noted that the integrating sphere method gave lower values than the

Table II.—Scattered Light Measurement Comparison of Integrating Sphere Method and A.S.T.M. D 672–42 T Method

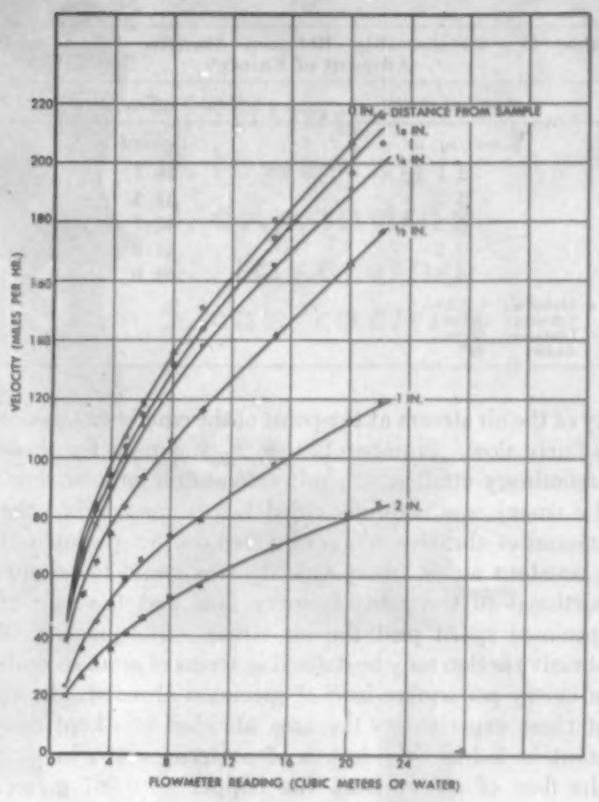
Specimen	*Scattered light*	
	A.S.T.M. Method D 672–42 T	*Integrating sphere method*
	Percent	*Percent*
1	2.0	2.0 (unabraded)
2	4.4	4.1
3	6.7	6.9
4	9.1	8.4
5	13.1	11.3
6	14.5	12.8
7	17.1	14.2
8	19.0	15.2
9	21.2	17.1
10	24.3	18.7
11	26.7	19.7
12	28.1	21.9
13	52.2	37.5

A.S.T.M. method. Reproducibility studies over a period of three months showed the integrating sphere method to be very precise; measurements could be checked within 0.1 percent deviation from the mean.

Procedure for making abrasion tests

The general procedure for operating this abrasion tester can be outlined as follows. The reducing valve *K* (Fig. 2) was set to the calibration pressure of 50 p.s.i. and the valve *Q* was opened until the flowmeter *J* showed the desired amount. Emery was then allowed to fall into the air stream while the specimen passed in front of it at a predetermined constant rate. An abrasion pattern $^7/_8$ by 1 in. or more was thereby obtained. The specimens were then wiped carefully with a dry cloth and the haze was determined.

The velocity of the air emitted from the $^1/_{16}$-in. nozzle was determined with a Pitot tube and compared with the flowmeter readings. In Table III and Fig. 4 these velocities are given at increasing distances from the nozzle. The variation in velocity across the air stream increased as the distance increased, but the change was small below 1–2 inches. The velocity at the center of the air stream decreased as the distance



This chart indicates the calibration of a nozzle for velocity and distance

from the nozzle increased. Tests made with emery in the air stream showed that the abrasion pattern was sharp and uniform below a distance of 1 inch. Wider patterns with fuzzy edges were obtained above 1 in., indicating that the air stream was fanning out appreciably. Therefore, for high velocity studies, $^1/_4$ in. was chosen as perhaps the optimum distance to use.

Rate of emery feed was determined by loading the emery into the hopper and observing the rate of flow into still air. It was assumed that the rate of flow into the moving air would be the same since the design of the apparatus eliminates any pressure drop and the veloc-

Table III. Calibration of Nozzle for Velocity

Flowmeter reading,	*Velocity of air at various distances from nozzle*					
	0 in.	*$^1/_8$ in.*	*$^1/_4$ in.*	*$^1/_2$ in.*	*1 in.*	*2 in.*
cu. meter	*m.p.h.*	*m.p.h.*	*m.p.h.*	*m.p.h.*	*m.p.h.*	*m.p.h.*
1	46.5	45.5	44.0	38.5	23.5	21.0
2	68.0	65.0	62.5	52.5	34.5	26.0
3	83.0	81.0	75.5	63.0	44.0	31.0
4	94.0	94.0	88.5	73.0	51.0	35.5
5	107.0	105.0	101.0	83.0	58.5	40.0
6	118.5	115.0	112.0	91.0	64.0	45.0
8	134.0	131.0	125.0	104.5	73.0	52.5
10	151.0	143.0	137.0	115.5	79.0	56.5
15	181.5	175.5	166.0	141.5	97.5	69.0
20	206.5	196.5	190.5	165.5	112.5	80.0
22	215.0	205.0	199.0	175.0	118.5	84.0

Table IV.—Relationship Between Abrasive Effect and Amount of Emery[a]

Amount of emery	*Abrasive effect (haze)*
g. sec./sq. in.	*Percent*
2.1	18.7
3.2	31.3
5.2	47.7
7.5	61.8
10.3	84.0

[a] Material: CR 39-1
Velocity: 200 m.p.h.
Distance: 1/4 in.
Angle: 90°

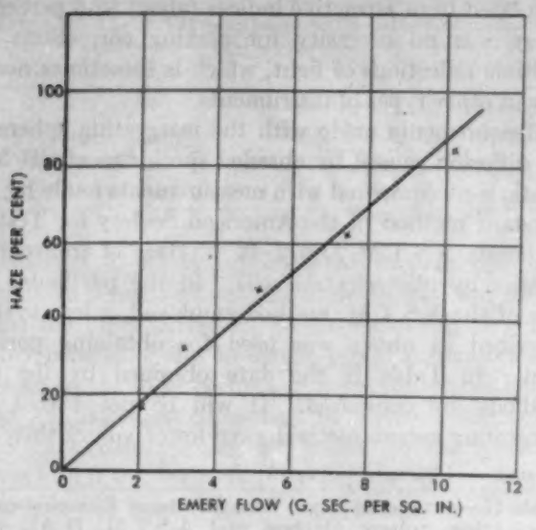
ity of the air stream at the point of the emery emergence is fairly slow. Number 120 emery was used for these preliminary studies. In order to obtain an even flow, the emery was carefully dried before use. Since the amount of abrasive action obtained on the specimen at a constant air or emery velocity was found to be proportional to the rate of emery flow and the rate of specimen speed past the air stream, the quantity of abrasive action may be defined in terms of gram seconds of emery per square inch of specimen abraded. In all of these experiments the area abraded was kept constant at 1.2 in., the length of pattern at 1 3/8 in. and the flow of emery from the hopper at 0.867 g./sec.

Discussion of test results

Effect of amount of emery—In Table IV[1] and Fig. 5 data are presented which show that a direct relationship existed between the amount of abrasive used and the abrasive effect as measured by the integrating sphere. These data would indicate that the haze method of measuring abrasion is correct since the haze is directly proportional to the abrasive action.

Effect of distance from nozzle to specimen—It has so far been assumed that the emery particles traveled at the same rate as the air in which they were suspended. In Table V are given data obtained at 100 and 200 m.p.h. at varying distances from the nozzle. There is a decided increase in the abrasive effect above 1/2 inch. However, since it was noted above that the air velocity

[1] All values of haze in this paper are uncorrected for the original haze of the specimens unless otherwise mentioned.

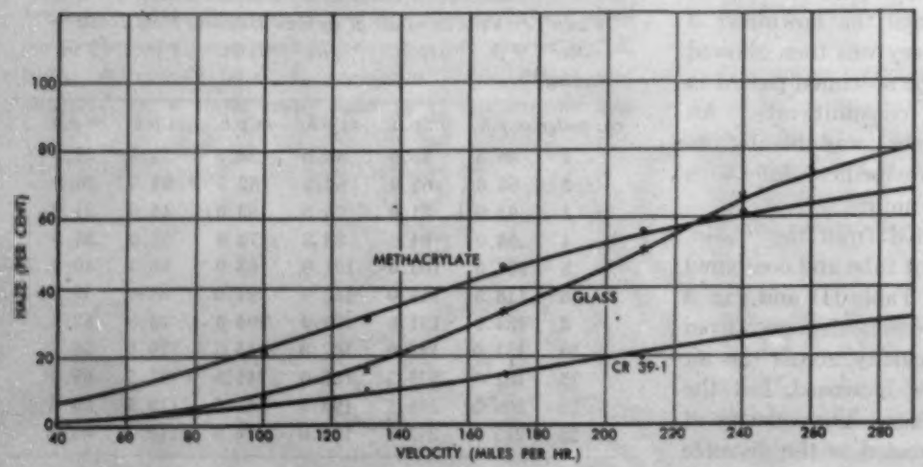


5—A chart showing the relationship that exists between the amount of abrasive used and the effect of that abrasive. Here CR 39-1 was tested at a velocity of 200 m.p.h. with the nozzle at a 90° angle and a 1/4 in. distance

diminished and the pattern widened above 1/2 in., it is apparent that either the emery is traveling faster after 1/2 in. or that some interference of flow of the air or the emery particles is taking place below 1/2 inch.

These effects are probably due to a pile-up of air in front of the specimen surface. This pile-up or cushioning probably also occurs under normal conditions of abrasion, and although its influence upon the extent of abrasion was here recognized, it was not studied further in this investigation. The success of this method therefore, depends upon keeping these effects constant at all times.

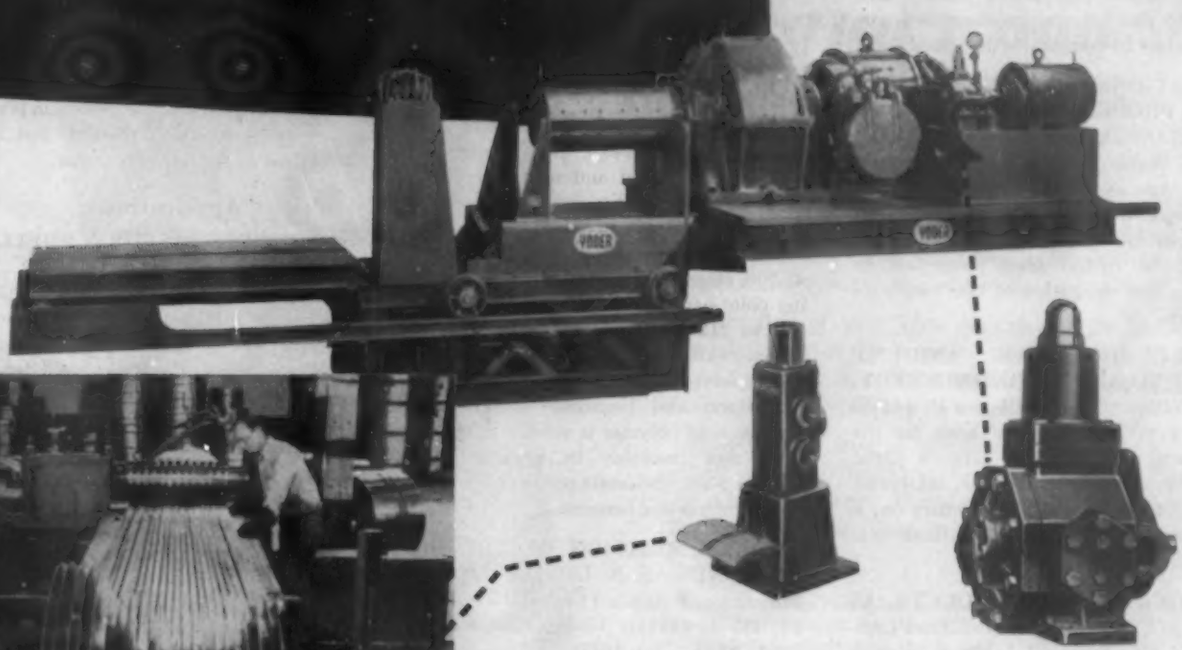
The impact of emery at such high velocity on the plastic and on the inner surfaces of the nozzle would, one would judge, soon wear down the sharp corners of the emery particles and give rise to lower abrasion on subsequent tests. This was experimentally proved; in a series of five runs the abrasive effect with the same emery decreased in the order (*Please turn to page 196*)

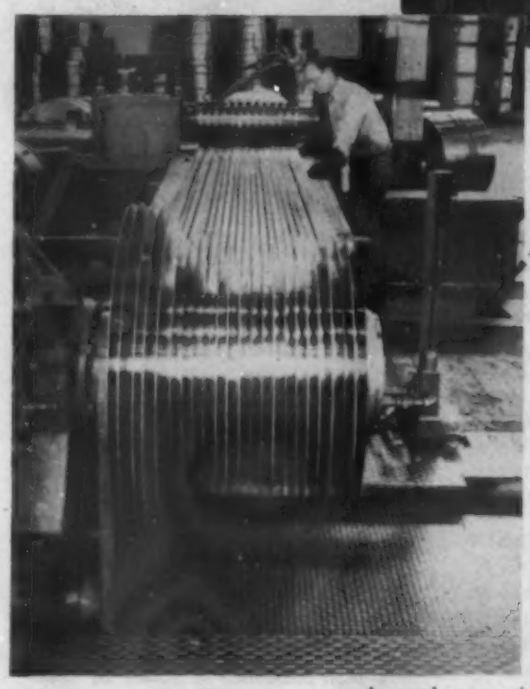


6—A chart of the effect of emery on glass, CR 39-1, and methyl methacrylate in relation to velocity of the abrasive particle. During the test the angle was 90°, the amount of emery used 2.1 g. sec./sq. in., and the distance 1/4 inch

5 POWER MOVEMENTS

1. lifting
2. lowering
3. expanding
4. traversing
5. contracting





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General

PROTECTIVE PACKAGING. O. C. Rutledge. Gen. Electric Rev. *48*, 16–19 (Dec. 1945). New packaging methods utilizing metals, chemicals, plastics and papers to protect equipment against corrosion while in transit are described.

RELATIONSHIPS OF COTTON FIBER PROPERTIES TO STRENGTH AND ELONGATION OF TIRE CORD. R. W. Webb and H. B. Richardson. Rubber Age *58*, 347–8 (Dec. 1945). The summary and conclusions of a report from the Department of Agriculture on "Relationship of cotton fiber properties to strength and elongation of tire cord" are presented.

HORN. FROM AN ANCIENT CRAFT TO A MODERN INDUSTRY. J. H. Collins. British Plastics *17*, 444–50 (Nov. 1945). The use of horn for the manufacture of buttons, lantern parts, tumblers, snuff boxes, spoons, ink-horns, combs, etc., from the 14th century on, is contrasted with the use of synthetic materials in the 20th century.

AGRICULTURAL PRODUCTS AS RAW MATERIALS FOR THE PLASTICS INDUSTRY. J. I. Jones. British Plastics *17*, 358–63, 419–28, 451–61 (Sept., Oct. and Nov. 1945). Agricultural products as raw materials for plastics are compared with petroleum and coal. The various agricultural products which appear useful and the materials which can be obtained from them are reviewed.

SUMMARY REPORT ON THE PRODUCTION OF GERMAN MEDICAL, SURGICAL AND SUNDRY RUBBER GOODS. Rubber Age *58*, 338–42, 351 (Dec. 1945). This is a report on the types of synthetic rubber bases, compounding ingredients, heat softening, legal aspects of German medical, surgical and rubber goods.

Materials

TESTING OF PLASTICS FROM SCHOLLER LIGNIN. R. D. Englert and L. Friedman. Pacific Plastics *3*, 38, 40 (Oct. 1945). The density, modulus of rupture and water absorption of experimental plastics made from Scholler lignin are reported. Woodflour, phenolic resin, phthalic anhydride, aniline, urea, furfural and water are used in some of the compositions. The density ranges from 1.29 to 1.40 g/cm.^{3} the modulus of rupture from very low values to 8900 p.s.i., and water absorption from 0.2 to 14 percent.

ALLYL ESTERS. N. H. Chamberlain. Plastics (London) *9*, 622–4 (Dec. 1945). The allyl ester resins are discussed briefly and their use in laminates considered.

PREPARATION AND POLYMERIZATION OF *p*-CYANOSTYRENE, *p*-VINYLBENZOIC ACID AND ITS METHYL ESTER. C. S. Marvel and C. G. Overberger. J. Am. Chem. Soc. *67*, 2250–2 (Dec. 1945). *p*-Cyanostyrene, *p*-vinylbenzoic acid and methyl *p*-vinylbenzoate were synthesized and the corresponding polymers prepared. The polymer molecular weights are 5310, 4710 and 45,000, respectively. The varying softening points are 200 to 225, 165 to 200 and 205 to 212° C., respectively. All three polymers are soluble in nitromethane. The *p*-cyanostyrene polymer is insoluble in chloroform and benzene. The *p*-vinylbenzoic acid polymer is soluble in chloroform and insoluble in benzene. The methyl *p*-vinylbenzoate polymer is soluble in chloroform and benzene.

POLYMERIZATION OF CHLOROSTYRENES. S. N. Ushakov and P. A. Matuzov. J. Applied Chem. (U. S. S. R.) *17*, 435–44 (1944); Chem. Abstracts *39*, 3692 (Aug. 20, 1945). Chlorostyrenes were polymerized at 100, 150 and 200° C. without catalyst and with benzoyl peroxide. Pure chlorostyrene polymerizes about three times faster than styrene. *m*-Chlorostyrene polymerizes at a rate slightly faster than *o*- and *p*-chlorostyrene. Reproducible products can be obtained only from freshly distilled chlorostyrenes.

EMULSION POLYMERIZATION OF STYRENE. C. C. Price and C. E. Adams. J. Am. Chem. Soc. *67*, 1674–80 (Oct. 1945). A method which gives satisfactory results for studying the rate of polymerization of styrene in soap emulsion was developed. The polymerization was completely inhibited by air. Under nitrogen, the rate of reaction was found to be independent of styrene content and dependent on the square root of the persulfate catalyst concentration. The concentration of the catalyst was shown to remain essentially constant during the polymerization. The kinetics are interpreted on the basis that the zero-order dependence of polymerization in emulsion on monomer content is not due to a difference in mechanism from solution polymerization but is limited by the solubility of the styrene in the water phase, within which the polymerization takes place. Polymerization of styrene emulsified by potassium dehydro-abietate or mixed hydro-dehydro-abietate gave a somewhat lower molecular weight polymer and a slightly slower rate of reaction than emulsification by soaps of high molecular weight fatty acid. Addition of dodecyl mercaptan to the polymerization greatly reduced the molecular weight of the polymer formed, as well as the induction period before polymerization started, but had little effect on the rate of reaction.

Applications

ADHESIVES BASED ON SHELLAC AND ITS DERIVATIVES. N. N. Murty. Plastics (London) *9*, 585–91 (Dec. 1945). High-bond-strength shellac adhesives can be prepared by incorporating a plasticizer like hydrolyzed lac, an inert filler like mica or slate dust and an adhesion promotor like tartaric- or malic-acid into the composition. The possible applications of these adhesives are listed. Some of these adhesives have already proved their merit in actual industrial use. The practical attainment of the full bond strength depends not only on their composition but also on the bonding technique employed and the care exercised in preparing the surface. In this latter respect, shellac-based adhesives are less exacting, for it is not necessary to roughen the surface to obtain high bond-strength. It is, however, essential to remove any grease present on the surface and, when bonding metals, it is essential to remove the oxide scale by acid pickling or by other means, otherwise the bond will be no stronger than that existing between the oxide scale and the metal. This precaution is particularly important when bonding electrical sheet laminations. Shellac-based adhesives, apart from possessing high bond strength to smooth surfaces, show high resistance to attack by transformer oil and petroleum type of hydrocarbons. Also their strength is not adversely affected by aging.

GLUED-LAMINATED ARCHES WITH SAWED LAMINATIONS. E. A. Dubin. Mech. Eng. *67*, 813–19, 838 (Dec. 1945). Well-sawed laminations for glue faces of glued-laminated structural members will produce joints of neat appearance and adequate strength if proper gluing and fabricating methods are used. Machining of surfaces to be glued should be required only as necessary to obtain uniform thickness of each lamination or to remove any rough or torn grain.

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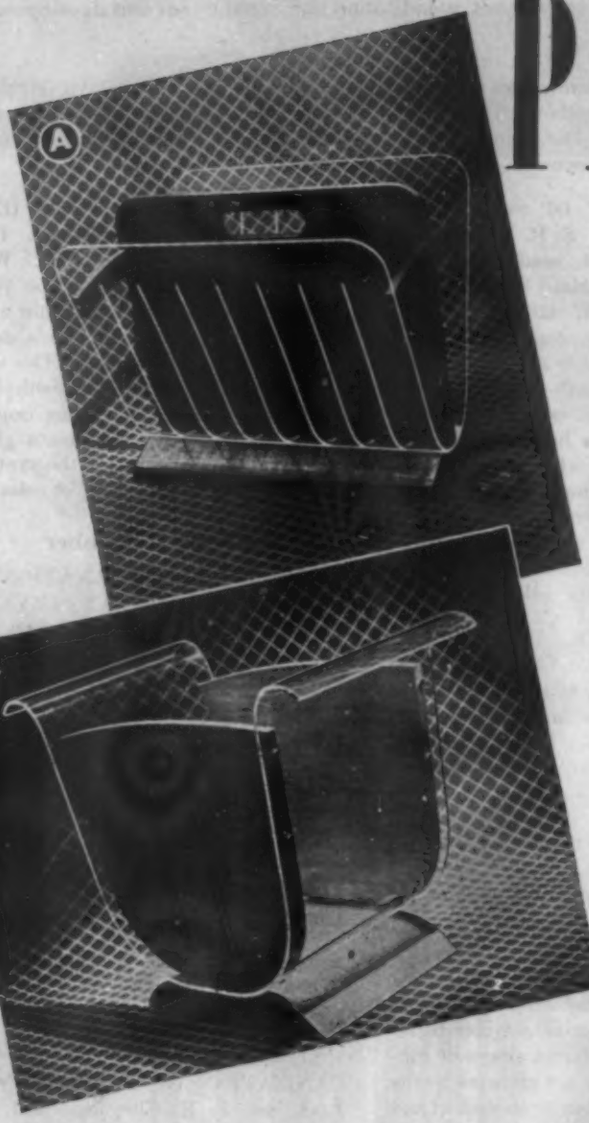

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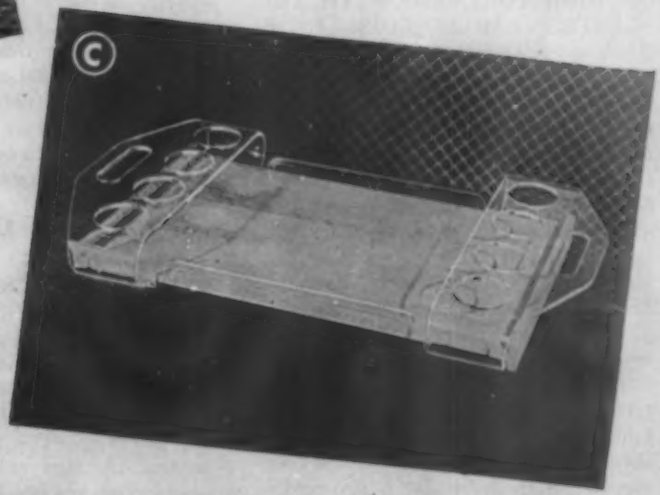

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Technical Briefs

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Engineering

UTILIZING PLASTICS AT TEMPERATURE EXTREMES. J. Delmonte. Machine Design *17*, 115–18 (Oct. 1945). Design problems encountered in utilizing plastics on equipment which is required to operate at high and low temperatures are discussed. These include changes in dimensions, changes in composition, thermal conductivity, flame resistance and post-forming.

SKIN HAZARDS IN THE MANUFACTURE AND USE OF CASHEW NUT SHELL LIQUID-FORMALDEHYDE RESINS. L. Schwartz, D. J. Birmingham, P. C. Campbell, Jr., and H. S. Mason. Industrial Medicine *14*, 500, 502, 504, 506 (1945). Workers who handle cashew nut shell liquid-formaldehyde resins during their preparation should be given the same type of protection as those handling phenol-formaldehyde.

SHORT WAVE WELDING GUN AIDS LAMINATING. J. Cunningham. Pacific Plastics *3*, 40, 42 (Dec. 1945). A portable short-wave welding gun suitable for curing resinous adhesives in assemblies of plywood, sheet stock, wood is described.

Chemistry

MOLECULAR WEIGHT STUDIES ON HIGH POLYMERS WITH THE ELECTRON MICROSCOPE. R. F. Boyer and R. D. Heidenreich. J. Applied Phys. *16*, 621–39 (Oct. 1945). Some preliminary results are reported on measurements of molecular weight distributions for polychlorostyrene. The following technique of isolating single polymer molecules is used: A precipitating agent, such as propanol, is added to a very dilute solution of the polymer in benzene, presumably causing the molecules to coil up. Drops of this mixture are evaporated on a silica screen and examined in the microscope. Circular particles ranging in diameter from 15 to 500 Å and believed to represent single polymer molecules were obtained on various polymers. The relationship between measured particle diameter and molecular weight is reviewed in some detail. The data appear to favor the concept of a random coil to the extent that particle diameter varies as the square root of the molecular weight. The molecular weight distribution curves obtained are of the expected shape and extent, although the average molecular weights computed from the distribution curves are 4 to 5 times greater than values measured by an independent method. The role of electrical charges in stabilizing isolated polymer molecules is discussed.

THE VISCOSITY OF SOLUTIONS OF POLYAMIDES. S. R. Rafikov and V. V. Korshak. Bull. acad. sci. (U. S. S. R.) Classe sci. chim. 432–9 (1944); Chem. Abstracts *39*, 4262 (Sept. 20, 1945). The viscosity of polyamides dissolved in *m*-cresol were measured. The polyamides were made by condensing hexamethylenediamine with adipic acid. These solutions show limiting values of concentration above which the solution gels. The viscosity number varies from linearity. The differences are greater the lower the molecular weight of the polymer; they are attributed to free amino groups on the ends of the molecules.

THE ABSOLUTE RATE CONSTANTS IN THE POLYMERIZATION OF LIQUID VINYL ACETATE. P. D. Bartlett and C. G. Swain. J. Am. Chem. Soc. *67*, 2273–4 (Dec. 1945). The rate constants for the polymerization of vinyl acetate are reported.

Properties

POLYMER PROPERTIES AS FUNCTIONS OF CONVERSION. F. T. Wall. J. Am. Chem. Soc. *67*, 1929–31 (Nov. 1945). Equations are derived by means of which "average" polymer data known as functions of conversion can be analyzed to give the properties of polymer increments forming at different stages of conversion. Suggestions are given as to the types of data which can be so studied and to possible interpretations of results.

Testing

X-RAY EXAMINATION OF LAMINATED PLASTICS. H. Barker. Machinery (London) *66*, 677–80 (June 21, 1945). X-ray equipment is used to inspect high-voltage paper-laminated phenolic bushings and other laminated plastic articles in the control of the manufacturing processes. The methods of process control, the type of equipment and the photographic materials used by a British manufacturer are described in detail.

TESTING METHODS FOR SYNTHETIC-RESIN RAW MATERIALS AND PREFORMED PRODUCTS. P. Nowak and W. Esch. Kunststoffe *34*, 59–61 (1944); Chem. Abstracts *39*, 4259–60 (Sept. 20, 1945). Specifications for cellulose triester and polyvinyl chloride sheets and for plasticizers are reported from the synthetic resin committee of the Verein Deutscher Chemiker.

WEBER COLOR TEST FOR IDENTIFICATION OF NATURAL RUBBER. I. F. C. Parker and W. C. Wake. Analyst *70*, 176–7 (1945). The Weber color test is apparently specific for an active methylene group next to a double bond in linear polyisoprenes. This structure occurs in natural rubber, methyl rubber and copolymers containing isoprene. Hevea, gutta-percha and balata give a strong violet color whereas the synthetic rubbers give a very faint violet color.

Synthetic rubber

CREEP AND RELAXATION IN RUBBER PRODUCTS AT ELEVATED TEMPERATURES. R. D. Andrews, R. B. Mesrobian and A. V. Tobolsky. Trans. A. S. M. E. *67*, 569–73 (Oct. 1945). The studies reported of creep and relaxation at elevated temperatures suggest possible methods of evaluating determinative changes occurring in rubbers. Involving intermittent and continuous relaxation and creep measurements, the new methods seem to be readily amenable to molecular-structural interpretation. The practical value of these measurements, apart from their usefulness in fundamental scientific research, is apparent in cases where deterioration occurs as a result of creep or relaxation.

STRUCTURAL CHANGES IN VULCANIZATION OF BUNA S. M. H. Keck and L. E. Cheyney. Ind. Eng. Chem. *37*, 1084–9 (Nov. 1945). The relations existing among combination of sulfur, loss of unsaturation, and development of physical properties were determined for four related butadiene-styrene polymer stocks over a range of cures at two temperatures. The data indicate that two types of chemical change occur during vulcanization: a) a reaction involving combination of the polymer with sulfur, which is primarily responsible for the development of physical strength, and b) a reaction involving loss of double bonds in the polymer, presumably a polymerization reaction, which is related to the first reaction and continues on overcure. A modification of the Kemp-Peters procedure for the measurement of unsaturation of butadiene-styrene vulcanizates is based upon the use of a phthalate-dichlorobenzene solvent mixture.

This intricate telephone connector block, complete with 21 metal inserts, was produced two up in a 50-ton H-P-M electronic molding press equipped with 12-1/2-ton transfer ram. Molder—Federal Telephone and Radio Corporation. Press cycle time—1-1/2 minutes. Parts were molded with high gloss finish, free from flash.

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U. S. Plastics Patents

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AIRCRAFT STRUCTURES. M. Jensen (to Langley Aviation Corp.). U. S. 2,388,485, Nov. 6. Structures are prepared composed of separately formed parts fastened with thermoplastic adhesive by means of heat and pressure.

LIGNOCELLULOSE. H. K. Linzell (to United States Gypsum Co.). U. S. 2,388,487, Nov. 6. The formation of autogenously produced binders resulting from treatment of lignocellulose is accelerated by heating with a ferric compound.

LIGNOCELLULOSE. A. J. A. Asplund and J. W. Holst (to Aktiebolaget Defibrator). U. S. 2,388,592, Nov. 6. Fibrous lignocellulosic pulp is prepared by impregnating straw with a quantity of a mineral acid sufficient to maintain a pH of 1 to 4, subjecting the mass to steam and then mechanically defibrating while in the presence of the steam.

CELLULOSE DERIVATIVE. W. J. Burke (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,388,597, Nov. 6. An O-(carboxymethylthioalkyl) cellulose.

EMULSION POLYMERS. H. M[2] Collins (to Shawinigan Chemicals Ltd.). U. S. 2,388,600-1, Nov. 6. A stable aqueous emulsion prepared by polymerizing in water a water-insoluble vinyl monomer in the presence of an anion-active surface tension depressant and two organic hydrophilic colloids.

EMULSION POLYMERIZATION. M. Kiar (to Shawinigan Chemicals Ltd.). U. S. 2,388,602, Nov. 6. An aqueous emulsion of a polyvinyl ester is prepared by polymerizing the ester with a peroxide catalyst in the presence of acetaldehyde and a hydrophilic organic colloid, the polymerization being carried out under reflux conditions.

ELASTOMER. H. Keller (to Monsanto Chemical Co.). U. S. 2,388,613, Nov. 6. An elastomer comprising the thermal reaction product of water-insoluble ethyl cellulose, a normally solid substituted polyphenyl hydrocarbon such as *o*-nitrodiphenyl, *o*-, *m*-, or *p*-diphenylbenzene, or mixtures thereof, and a hydrogenated higher fatty acid glyceride, the materials with exception of the ethyl cellulose being formed into a hot melt, the ethyl cellulose being then incorporated therein and the mass being finally heated for from 20 min. to 4 hr. at 140 to 240° C.

RUBBER HYDROCHLORIDE. L. E. Cheyney (to Wingfoot Corp.). U. S. 2,388,651, Nov. 6. Rubber is hydrochlorinated in solution in an aromatic hydrocarbon in the presence of a catalyst, thereby reducing the ripening period.

PAINT COMPOSITION. J. G. Lichty and N. V. Seeger (to Wingfoot Corp.). U. S. 2,388,656, Nov. 6. A paint composition comprising a solution of a condensation derivative of rubber, a drying oil and a little organic diisocyanate.

SYNTHETIC POLYAMIDES. D. D. Coffman and H. B. Stevenson (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,388,676, Nov. 13. A synthetic linear polyamide is prepared having improved resistance to sunlight by impregnating with a solution of resin-forming components comprising catechol, formaldehyde and an acid catalyst, and heating to promote condensation.

ELASTOMER. C. O. Guss and R. W. Amidon (to Dow Chemical Co.). U. S. 2,388,685, Nov. 13. A solid thermoplastic polymer which is flexible at temperatures as low as −50° C. is prepared by polymerizing styrene in aqueous emulsion and polymerizing butadiene in same emulsion.

CELLULOSE ETHERS. F. Reichel and R. T. K. Cornwell (to Sylvania Industrial Corp.). U. S. 2,388,764, Nov. 13. Cellulose ethers are prepared by dissolving a low etherified cellulose ether in an aqueous solution of a strongly basic hydroxide adding an alkylating, hydroxyalkylating or carboxy-alkylating agent thereto with a gradual rise in temperature so that it does not exceed 70° C., until a water-insoluble ether is formed.

SAFETY GLASS. M. Knight and C. D. Lowry (to Libbey-Owens Ford Glass Co.). U. S. 2,388,786, Nov. 13. Safety glass comprising an interposed layer of plastic material attached to two sheets of glass, the interlayer extending beyond the glass sheets and having embedded a metal member having a laterally enlarged portion.

POLYVINYL KETAL ACETAL. J. D. Ryan and F. B. Shaw, Jr. (to Libbey-Owens Ford Glass Co.). U. S. 2,388,802, Nov. 13. A synthetic resin prepared by reacting a hydrolyzed polyvinyl acetate with methyl ethyl ketone and butyraldehyde, and having as plasticizer an ester of a straight chain dicarboxylic acid.

PHOTOGRAPHIC FILM. A. E. Beguin and D. R. Swan (to Eastman Kodak Co.). U. S. 2,388,817, Nov. 13. A photographic film comprising a support of a vinyl chloride polymer, a layer of a polybutyl methacrylate, a cellulosic subbing layer and an emulsion layer.

ADHESIVE. M. H. Hecht (to Atlas Mineral Products Co.). U. S. 2,388,846, Nov. 13. An adhesive for bituminous surfaces comprising a coumarone-indene resin applied in a nitroparaffin solvent.

RESIN SOLUTION. W. O. Kenyon and W. E. Fowler, Jr. (to Eastman Kodak Co.). U. S. 2,388,851, Nov. 13. A water-soluble resinous material which becomes insoluble when the water has evaporated, comprising the deesterification product in alcoholic solution of a copolymer of vinyl acetate and a monobeta-chloroallyl ester of a monocarboxylic acid such as benzoic or an aliphatic acid.

MOLDING. A. J. Smith (to Hartford-Empire Co.). U. S. 2,388,876, Nov. 13. An apparatus for forming hollow articles from moldable charges of plastic material in continuous process.

PRINTING PLATE. A. J. Spelker (to Atlas Electrotype and Stereotype Co.). U. S. 2,388,878, Nov. 13. A method for producing precision thickness plastic printing plates.

FILMS. G. P. Mack (to Advance Solvents and Chemical Co.). U. S. 2,388,984, Nov. 13. Compositions for producing self-sustaining films capable of heat sealing at elevated temperatures comprising polyisobutylene cyclized rubber and a microcrystalline petroleum wax.

TUBING. M. German. U. S. 2,389,038, Nov. 13. Plastic tubing is bent by filling with a finely ground dehydrated substance, plugging the ends, suspending over a contour form, introducing into a bath of heated liquid, allowing to assume the contour of the form and cooling the liquid.

CONDENSATES. D. W. Jayne, Jr., and H. M. Day (to American Cyanamid Co.). U. S. 2,389,150, Nov. 20. A solid condensate prepared by heating an aldehyde with the solid obtained by heating a primary aromatic amine with dicyandiamide.

ADHESIVE. C. N. Cone (to M and M Wood Working Co.). U. S. 2,389,183, Nov. 20. Plywood is prepared by assembling wood veneers with a glue comprising a mixture of a protein glue and an aqueous solution of a phenol-formalde-

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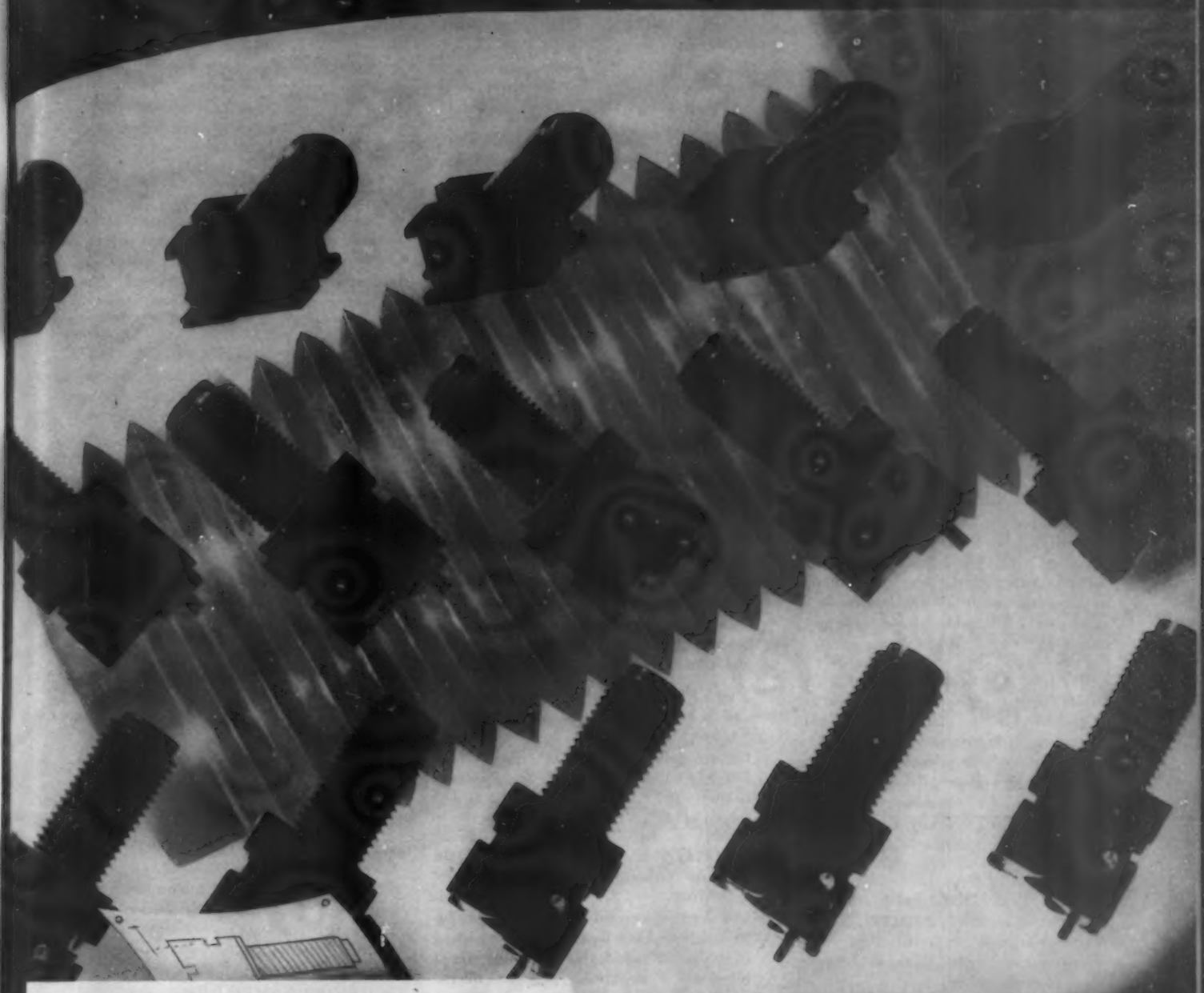

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TECHNICAL NOTES — Molded with 24 threads to the inch, each of these pieces comes out of the mold with threads entirely free of flash. Overall shrinkage is .008-inch — .00033-inch between threads.

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hyde resin and heating under pressure to cure the resin.

CELLULOSE ESTERS. C. I. Haney, M. E. Martin and T. E. McGoury (to Celanese Corp. of America). U. S. 2,389,195, Nov. 20. In the preparation of cellulose esters of high degree of esterification comminuted wood is digested with a lower aliphatic acid at 130° C., the liquor is removed and the partially esterified cellulose is further esterified.

AIRFOIL. E. C. Pitman (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,389,210, Nov. 20. An airplane wing having improved airfoil characteristics comprising a pre-shaped metal body consisting of a porous core of synthetic resin, and an outer surface of rubber.

PLASTIC. W. W. Koch (to Hercules Powder Co.). U. S. 2,389,370, Nov. 20. A plastic composition comprising ethyl cellulose and a para-substituted methyl catechol.

RESIN. G. F. D'Alelio (to General Electric Co.). U. S. 2,389,415-6, Nov. 20. A resin comprising the reaction product of a polyamide such as urea, malonic diamide, or phthalamide, an aldehyde and a salt of an amino acid or sulfanic acid.

RESIN. G. F. D'Alelio and J. W. Underwood (to General Electric Co.). U. S. 2,389,418, Nov. 20. A plywood resin comprising the reaction product of an alkaline catalyzed phenol-aldehyde condensate, a derivative of a polycarboxylic acid containing a free carboxyl group and an amidated carboxyl group, and an aldehyde-reactable monohydroxy aryl sulfonic acid.

ABRASIVE. R. L. Smith (to Carborundum Co.). U. S. 2,389,462, Nov. 20. Abrasive articles are prepared by wetting abrasive grains with a liquid heat-hardenable phenolic resin, mixing with zein powder and molding under heat and pressure.

POLYSILOXANE RESINS. J. G. E. Wright and J. Marsden (to General Electric Co.). U. S. 2,389,477, Nov. 20. Polysiloxane resin is prepared by dissolving a methyl polysiloxane resin intermediate in toluene, treating with antimony pentachloride and a hydrated iron chloride in the presence of heat under reflux, washing with water and finally recovering the polysiloxane resin.

ABRASIVE. R. J. Dunlap and R. J. Schatz (to Monsanto Chemical Co.). U. S. 2,389,491, Nov. 20. An abrasive comprising abrasive grains bonded by a resinous condensate of orthosilicic acid which has been reacted with alkyl, aryl or aralkyl compounds.

JOINING. R. N. Steffens. U. S. 2,389,560, Nov. 20. Apparatus for joining end portions of thermoplastic strips.

PICKER STICK. O. L. Carter and T. A. Putnam. U. S. 2,389,595, Nov. 27. A plastic picker stick for looms comprising a longitudinally extending reinforcing member around which the plastic is molded.

LINEAR POLYAMIDES. E. L. Martin (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,389,628, Nov. 27. A polyamide comprising the reaction product of a linear polymer-forming mixture comprising 4-mercaptopimelic acid and a diamine.

LINEAR POLYAMIDES. C. W. J. Wende (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,389,655, Nov. 27. Synthetic linear polyamide articles of improved properties are prepared by drying the article and then heating while under tension.

POLYMERS. N. G. Fisher and R. H. Wiley (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,389,662, Nov. 27. The synthetic linear condensation polymeric spirothioketal of tetrakis (mercaptomethyl) methane and cyclohexane-dione-1,4.

RESIN. W. Nebel (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,389,682, Nov. 27. A resin is prepared by condensing dimethylol-urea with a methylol ketone in the presence of an acidic catalyst and a lower aliphatic monohydric alcohol.

OLEFIN POLYMERS. W. J. Sparks and R. M. Thomas (to Jasco, Inc.). U. S. 2,389,693, Nov. 27. Isoolefins and diolefins are polymerized in the presence of a Friedel-Crafts catalyst at temperatures below −10° C. while the catalyst is dissolved in carbon disulfide.

COATINGS. J. J. Zolad (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,389,708, Nov. 27. A coating composition containing solid granular ethyl cellulose dispersed in a liquid vehicle consisting of drying or semidrying vegetable oils or oil-modified alkyd resins, pigments, fillers.

CONDENSATE. W. P. Ericks and M. C. Whitaker (to American Cyanamid Co.). U. S. 2,389,723, Nov. 27. A guanidine modified starch is prepared by condensing tapioca starch and guanidine carbonate in the presence of concentrated hydrochloric acid under reflux, followed by neutralization with sodium hydroxide and subsequent recovery of the product.

COIL. E. C. Lee (to International Standard Electric Corp.). U. S. 2,389,733, Nov. 27. An electric coil is prepared by winding paper carrying a synthetic resin into a form, winding a layer of coiled wire around the paper, winding another layer of impregnated paper around the coil and finally bonding the assembly with heat.

WRINKLE COATINGS. E. L. Luaces (to New Wrinkle, Inc.). U. S. 2,389,794-5, Nov. 27. Wrinkle coating compositions comprising a resinous reaction product of glycerol and phthalic anhydride, fatty acids, top drier and hydrocarbon diluents; the fatty acids being obtained by treating a vegetable oil with alcoholic ammonia or alkali metal hydroxide under reflux to cause rearrangement of the non-conjugated double bonds and soap formation, and then isolating the acids.

COATING. C. Bogin (to Commercial Solvents Corp.). U. S. 2,389,837, Nov. 27. A coating composition comprising a resin formed by reacting phthalic anhydride, glycerol, and drying oil fatty acids, a hydrocarbon solvent and a nitroparaffin solvent.

RESIN. G. F. Mills and A. V. Alm (to Chemical Process Co.). U. S. 2,389,865, Nov. 27. A porous, ion-exchange, carrier resin resulting from the heat condensation of phenol and formaldehyde in the presence of an alkali metal hydroxide, the character of the gel being controlled by the amount of caustic which is used in proportions sufficient to preclude separation of the reactable substance before gelation, but insufficient to cause the gel to be translucent or transparent, and thereafter drying the resin.

ALKYD RESINS. G. F. D'Alelio and J. W. Underwood (to General Electric Co.). U. S. 2,389,896, Nov. 27. A coating composition comprising a solution, in an organic solvent, of a soluble fatty oil-modified alkyd resin and a fusible soluble resin obtained by heat reacting, under alkaline conditions, a 1-aryl substituted guanazole with an aldehyde, in the absence of an alcohol, until the resin is solid at room temperature.

MOLDING COMPOSITION. J. K. Speicher (to Hercules Powder Co.). U. S. 2,389,940, Nov. 27. A molding powder consisting of a cellulose ether or ester is prepared by forming an aqueous slurry of the material; adding a solution containing a plasticizer, a dye and a water-miscible solvent; agitating the mixture; removing the water phase, and finally drying.

RECOVERY PROCESS. J. W. C. Crawford and A. D. Jones (to Imperial Chemical Industries Ltd.). U. S. 2,389,958, Nov. 27. Solid chlorinated polyvinyl chloride is recovered from solution in a volatile organic solvent by contacting with steam in a hot aqueous medium containing a small amount of a water-soluble high-molecular-weight colloid.

HANDBAG. C. Wolf (to Plasco, Inc.). U. S. 2,390,021, Nov. 27. A decorative, flexible handbag material including a field of oblong, interfitted, box-like decorative elements molded of plastic material.

CELLULOSIC FIBERS. J. W. Stallings (to Rohm and Haas Co.). U. S. 2,390,032-3, Nov. 27. The luster and water-receptivity of cellulosic yarns and fabrics are increased by treating with acrylonitrile and an aqueous solution of strong hydroxide. (*Please turn to next page*)

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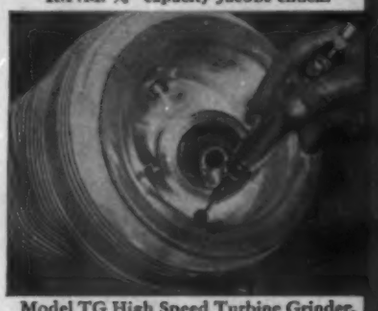

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VINYLIDENE CHLORIDE. R. M. Wiley (to Dow Chemical Co.). U. S. 2,390,035, Nov. 27. Normally crystalline polymers of vinylidene chloride are treated by fusing, supercooling, maintaining at 20° C. for a period insufficient to effect crystallization while restricting any mechanical deformation to within the elastic limit, and finally heating to above 50° C., but below the fusion point, thus forming a product which is cold-workable, haze-free and crystalline.

BINDER CASE. F. S. Schade (to National Blank Book Co.). U. S. 2,390,125, Dec. 4. A book binder case comprising an overall sheet of limp transparent thermoplastic material.

CASTING. S. M. Shobert (to Marco Chemicals, Inc.). U. S. 2,390,129, Dec. 4. A casting cell, for casting a polymerizable liquid, comprising top and bottom walls of rigid material, fluid-tight collapsible tubing containing fluid under pressure separating the walls and serving as side walls, and means for releasing the fluid.

SPINNING. A. F. Smith and H. B. Stevenson (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,390,132, Dec. 4. An improved dryspun hydrolyzed ethylene-vinyl acetate interpolymer filament is prepared by spinning a solution of the resin, heating the filament under tension, and finally drawing to at least 100 percent of its original length.

CONDENSATES. R. Kern (to Alien Property Custodian). U. S. 2,390,153, Dec. 4. A water and organic solvent insoluble nitrogenous condensate of an aliphatic diamine and an aldehyde or a ketone is solubilized by heating with three times its weight of 30 percent aqueous formaldehyde.

COPOLYMERS. E. W. Moffett and R. E. Smith (to Pittsburgh Plate Glass Co.). U. S. 2,390,164, Dec. 4. A resinous material prepared by conjointly polymerizing vinyl chloride and an ester of allyl alcohol and a saturated monocarboxylic acid.

CELLULOSE ESTERS. G. W. Seymour and B. B. White (to Celanese Corp. of America). U. S. 2,390,185, Dec. 4. Cellulose acetate stearate is prepared by esterifying cellulose with stearyl chloride in pyridine, separating, washing and drying, and further esterifying with acetic anhydride and an esterification catalyst in suspension in acetic acid and benzene.

MASTIC. F. J. Soday (to United Gas Improvement Co.). U. S. 2,390,189-90, Dec. 4. A mastic composition comprising fibrous material and a resinous material such as the heat or catalytic polymer of polymerizable hydrocarbons.

RESIN. A. Voss, K. Dietz and H. Thomas (to Alien Property Custodian). U. S. 2,390,198, Dec. 4. A heat-hardenable resin comprising the condensate of a phenol and an aldehyde in the resol state and a halogen-containing interpolymerizate obtained by copolymerizing vinyl chloride and maleic anhydride, vinyl acetate and chloromaleic anhydride, or styrene and chloromaleic anhydride.

COATING. J. L. Krieger. U. S. 2,390,217, Dec. 4. Lacquers having a nitrocellulose base and a pigment such as bronze powder or copper powder are rendered color stable by the inclusion of a powdered metal having a higher electrode potential than copper.

TEXTILES. K. H. Barnard and B. Frankfurt (to Pacific Mills). U. S. 2,390,235, Dec. 4. Textile materials are rendered wash resistant by applying an alkaline solution of an alkali-soluble cellulose ether, applying acid to insolubilize, and then applying a quaternary ammonium salt.

TUBE BASE. T. W. Keller. U. S. 2,390,308, Dec. 4. A plastic body for use in making a base for radio tube elements.

SILICONE RESINS. J. Marsden (to General Electric Co.). U. S. 2,390,378, Dec. 4. Mixtures of silicon halides, including methyl silicon halides, are hydrolyzed to form insoluble gels when mixed with water, by dissolving in an asymmetric ketone and slowly adding the solution to a hydrolysis medium consisting of water below 30° C., but containing no ice.

BRUSHES. R. H. Hayes (to Monsanto Chemical Co.). U. S. 2,390,437, Dec. 4. Articles made from polymerized vinyl aromatic compounds are bristled and stapled by heating above the critical temperature and inserting bristles and staples.

FURYLETHYLENE POLYMERS. C. J. Mighton (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,390,446, Dec. 4. A sulfur-vulcanized composition comprising a furylethylene polymer plasticized with a sebacic ester and reinforced with carbon black.

RESIN. T. C. Whitner (to Chemical Laboratories, Inc.). U. S. 2,390,481, Dec. 4. A water-soluble, naturally occurring gum is admixed with a water-soluble condensate of acetone and formaldehyde prepared by reacting formaldehyde with acetone in an aqueous solution of an inorganic alkali and heating slightly.

SHOE WELT. W. C. Wright (to Wright-Batchelder Corp.). U. S. 2,390,485, Dec. 4. A shoe structure comprising an upper, an outsole and a welt formed of waterproof, plasticized vinyl resin.

MOLDED ARTICLE. C. W. Egan. U. S. 2,390,525, Dec. 11. A gas check pad comprising a core member consisting of a compressed, baked, shredded mass of asbestos fibers and a heat-polymerized oil.

SYNTHETIC GUM. H. L. Gerhart and L. M. Adams (to Pittsburgh Plate Glass Co.). U. S. 2,390,530, Dec. 11. A varnish composition comprising a mixture of a drying oil and a copolymer of a drying oil and a diene hydrocarbon.

SEALING APPARATUS. G. A. Moore (to Shellmar Products Co.). U. S. 2,390,550, Dec. 11. A heat-sealing device for hermetically sealing thermoplastic faces on food containers.

SEALING METHOD. J. P. Staples (to Pittsburgh Corning Corp.). U. S. 2,390,561, Dec. 11. A glass jar fitted with a screwcap lid is sealed with a layer of cellular plastic which adheres to one set of screw threads, but not to the other.

COLD MOLDING. W. E. Williams. U. S. 2,390,567, Dec. 11. A formed article of methyl methacrylate is prepared by treating methyl methacrylate polymer with concentrated hydrogen peroxide in the absence of heat until the desired softness is attained, shaping the mass and removing hydrogen peroxide by evaporation.

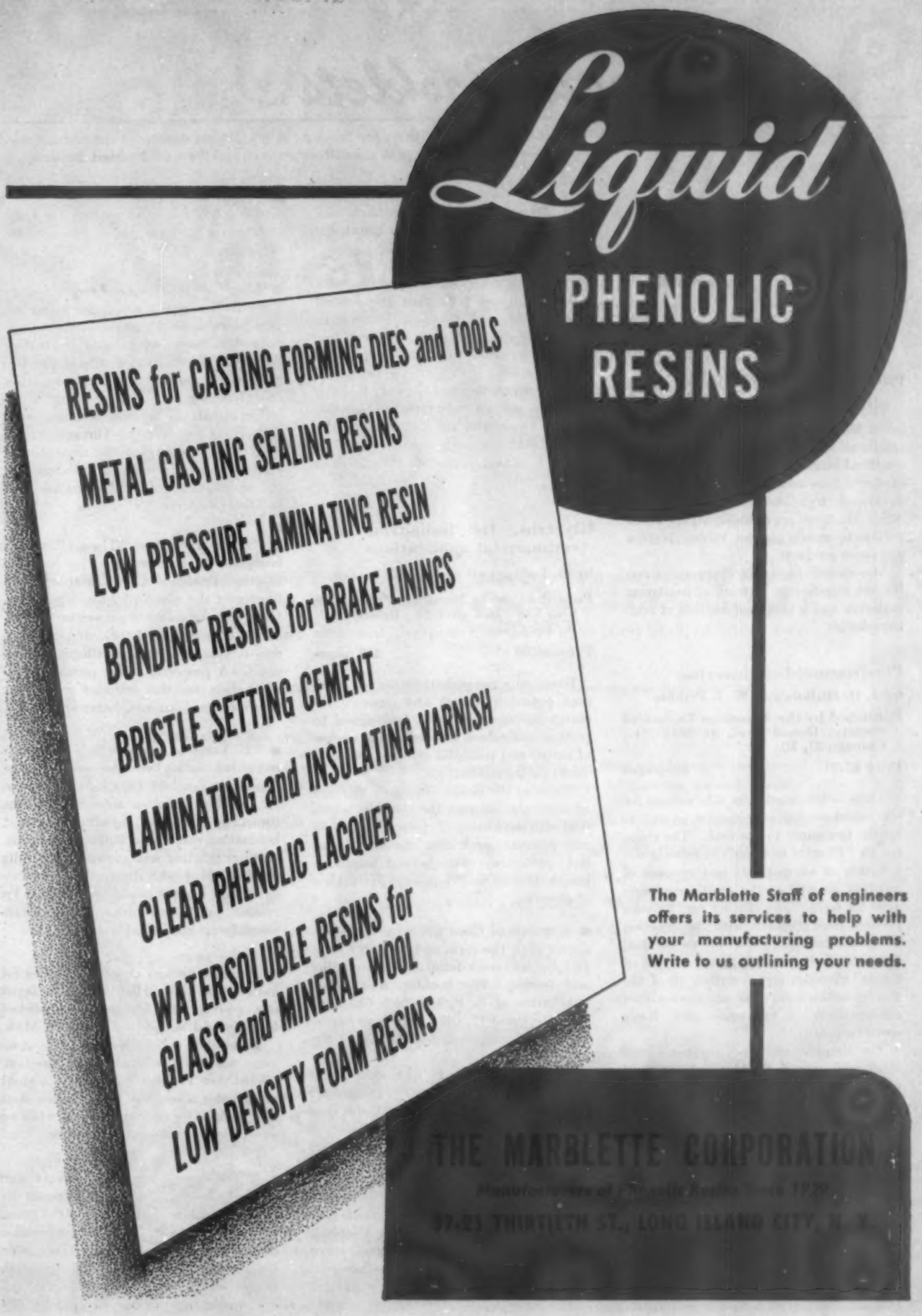
OLEFIN POLYMERS. B. H. Shoemaker and E. L. d'Ouville (to Standard Oil Co.). U. S. 2,390,621, Dec. 11. An unsaturated, high-molecular-weight hydrocarbon polymer is prepared by subjecting a saturated linear polymer, prepared by polymerizing an olefin with a Friedel-Crafts catalyst, to treatment with a halogen in the presence of a Friedel-Crafts catalyst and separating the polymer.

DECORATIVE MATERIAL. H. Hudgins (to Sloane Blabon). U. S. 2,390,712, Dec. 11. A floor-covering material comprising a layer of backing material having secured thereto blocks of plastic material.

BLOOD TREATMENT. N. M. Nesset (to Baxter Laboratories, Inc.). U. S. 2,390,727, Dec. 11. Separation of blood plasma from whole blood is facilitated by the use of methyl cellulose.

COATING. E. C. Wahlberg (to Electrolux Corp.). U. S. 2,390,758, Dec. 11. A simulated metallic coating is prepared by applying to a surface a baking lacquer undercoat comprising urea-formaldehyde and a colored pigment, baking the undercoating, applying a second coat of pearl essence mixed with clear lacquer and spraying with lacquer thinner to reduce thickness of lacquer over the pearl essence.

TEXTILE COATING. R. T. K. Cornwell (to Sylvania Industrial Corp.). U. S. 2,390,780, Dec. 11. A flexible waterproof fabric is prepared by coating a porous fabric with an aqueous alkaline solution of an alkali-soluble cellulose ether, coagulating to form a coating, applying pressure, applying a heat-curable phenol-formaldehyde, urea-formaldehyde or melamine-formaldehyde resin, evaporating the solvent, curing the resin, applying a film-forming cellulose compound and finally evaporating the solvent vehicle from the top coat.


Liquid
PHENOLIC
RESINS
RESINS for CASTING FORMING DIES and TOOLS
METAL CASTING SEALING RESINS
LOW PRESSURE LAMINATING RESIN
BONDING RESINS for BRAKE LININGS
BRISTLE SETTING CEMENT
LAMINATING and INSULATING VARNISH
CLEAR PHENOLIC LACQUER
WATERSOLUBLE RESINS for
GLASS and MINERAL WOOL
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Books and Booklets

Write directly to the publishers for these booklets. Unless otherwise specified, they will be mailed without charge to executives who request them on business stationery.

A.S.T.M. standards on electrical insulating materials (with related information)

Prepared by A.S.T.M. Committee D-9 on Electrical Insulating Materials

Published by the American Society for Testing Materials, 260 S. Broad St., Philadelphia 2, Pa., October 1945, issued annually

Price $3.25 **545 pages**

This special compilation gives in their latest form the more than 75 widely used specifications and test methods covering electrical insulating materials and related products. In addition to the standards developed by Committee D-9 of the A.S.T.M., there are included others which pertain to certain plastics, rubber, textiles and paper products.

Also included are several reports covering the significance of tests of insulating materials and a proposed method of testing askarels.

Plastics mold engineering

by J. H. DuBois and W. I. Pribble

Published by the American Technical Society, Drexel Ave., at 58th St., Chicago 37, Ill.

Price $7.00 **495 pages**

There is information in this volume for the experienced plastic molder as well as for the newcomer to the field. The chapter on "Plastics molding" includes a description of all methods and systems of molding, as well as the plastic materials used for tools. The chapter on "Plastics product design" starts with the selection of the material and carries on to the final finishing of the molded part. "Types of molds" classifies and describes all of the more common mold types and gives a short condensation of Ordnance and Navy specifications.

The chapters on "Tool making equipment and methods," "Materials for mold making" and "Designing and drafting practice" are a complete book in themselves which should be entitled the "Art of mold designing and mold making." The chapters on "Compression molds," "Injection molds" and "Cold mold and extrusion die design" are a comprehensive discussion of all the so-called "secrets" of this phase of the plastics industry. "Special fixtures" covers such subjects as loading boards, stripping fixtures, shrink blocks and drill jigs. Finally, the chapter on "Mold sampling and maintenance" completely rounds out a thorough and comprehensive coverage of the knowledge required by plastics technicians.

The Appendix includes many reference tables which are useful to mold designers and the authors state that the general properties of materials given therein have been rated by the same identical test methods in order to make comparisons more accurate.

This presentation will not only be helpful to all plastics engineers, but particularly to those who are just entering the plastics field and wish to make a serious study of various phases of this art.

F.B.S.

Glycerin, its industrial and commercial applications

by G. Leffingwell and M. A. Lesser

Published by Chemical Publishing Co., Inc., 26 Court St., Brooklyn 2, N. Y., 1945

Price $5.00 **259 pages**

Based on a comprehensive survey of recent patent literature and reported research findings, this book is designed to present a digested and indicative review of actual and potential glycerin uses in a variety of industrial fields.

Those in the plastics industry will find of particular interest the chapters which deal with the history of glycerin, adhesives and cements, packaging materials, plastics, protective coatings and insulating paints, textiles and dyes, and derivatives of glycerin.

● A review of Geon polyvinyl materials covers both the resin and the latex form and goes into some detail on the processing and testing. The booklet, which is a publication of B. F. Goodrich Chemical Co., Cleveland 15, Ohio, carries an extensive list of suggested applications of the material.

Received from the B. F. Goodrich Co. is a "Guide Book for Industrial Designers" which presents data on Koroseal, and synthetic and natural rubber.

● Two silicone products, DC mold release fluid and DC 7 compound, as they are used by the rubber and plastics industries, are described in a pamphlet prepared by Dow Corning Corp., Midland, Mich. The two mold release agents serve as lubricants and are said to reduce friction between dies and plastic materials, improve plastic flow, reduce surface striation and afford easy release from the mold or from rubber bags used in low-pressure laminating.

● A new review published by E. I. du Pont de Nemours & Co., Inc., Arlington, N. J., gives a quick, concise picture of the properties, forms, workability and uses of polythene, Lucite, nylon, Plastacele, Pyralin and Butacite. A general properties chart is included.

The eighth of a series of technical service reports prepared by the same company discusses mechanical requirements and recommended molding techniques for the successful use of FM-1 nylon injection molding powders.

● "Saran, the Magic Thread," a gay four-color booklet prepared by National Plastics Products Co., Odenton, Md., illustrates the manner in which that material may be adapted to women's accessories, luggage, upholstery, drapery, window screens and tennis and fishing equipment. A properties chart presents technical data on the extruded vinylidene chloride monofilaments, rattan and tape.

● "25 Years of Progress in Plastics" is recounted in a two-color booklet just issued by Emeloid Co., Inc., Arlington, N. J. The various services offered by the company, such as injection molding, laminating, machining, buffing, embossing, cutting, printing and stamping are fully detailed along with illustrations of fabricated and molded products. Articles for resale, and advertising and premium novelties are also included.

● Plastic reflectors and lamp shades for indirect and diffused lighting are displayed in a two-color pamphlet recently published by General Electric Co., Pittsfield, Mass.

In another publication the same company answers the much-asked question, "What Are Plastics?" and gives a short but graphic account of how plastics came into being, why they stayed and what we may expect from them in the future.

● A monograph on "Instruments and Process Control" has been prepared by the Curriculum Laboratory at Cornell University, Ithaca, N. Y., in cooperation with the Taylor Instrument Companies, Rochester, N. Y. The 234-page spiral-bound booklet covers topics including: importance of mea- (*Please turn to page 190*)

CMPC now takes another great step forward. This time it's a new, expanded Thermoplastics Division, housed in its own modern building for maximum efficiency, and staffed throughout by CMPC's seasoned personnel. Steps already completed, or under way, include:

- **The purchase of a modern building 200 feet long, immediately adjoining our main plant on the north.**
- **The construction of a new section to join the two plants.**
- **The installation of new, up-to-the-minute injection molding machines ranging up to twenty-two ounces . . . enabling us to *triple* our former production of injection molded parts.**

These new facilities will be in full operation this summer. But they are only the beginning . . . the first step in a million dollar expansion program to make CMPC's outstanding facilities for compression and injection molding available to more industrial users of plastics than ever before. So if you are planning to use molded plastics in the future, we invite you to take advantage of these expanded facilities, backed by CMPC engineering skill. Just call in a CMPC Development Engineer. There's no obligation.

CHICAGO MOLDED PRODUCTS CORPORATION

Plastic Molders

1046 N. Kolmar Ave. Chicago 51, Illinois

COMPRESSION AND INJECTION MOLDING OF ALL PLASTIC MATERIALS

New Machinery and Equipment

● A new type of universal toolmaker's lathe has been developed expressly for mold makers by Monarch Machine Tool Co., Sidney, Ohio. In addition to all standard accessories required for lathe operations, this unit has an adjustable leadscrew variating mechanism which can be adjusted to compensate for shrinkage of the material being molded. When a thread is placed in a mold and extreme accuracy is required, the lead of the thread must be greater in proportion to the shrinkage of the material. If shrinkage is 3 percent, the leadscrew variating mechanism can be so set; if shrinkage is only 0.001 in. per 1 in. it can be set to compensate for this small amount of shrinkage. The thread can then be chased in the mold following normal procedure. The machine is also equipped with a speed reducer which permits lathe speeds as low as a fraction of a revolution per minute. The lathe is available in a size corresponding to a 12 in. toolroom lathe, swinging 14½ in. over the bed, with a distance between centers of either 30 or 54 inches.

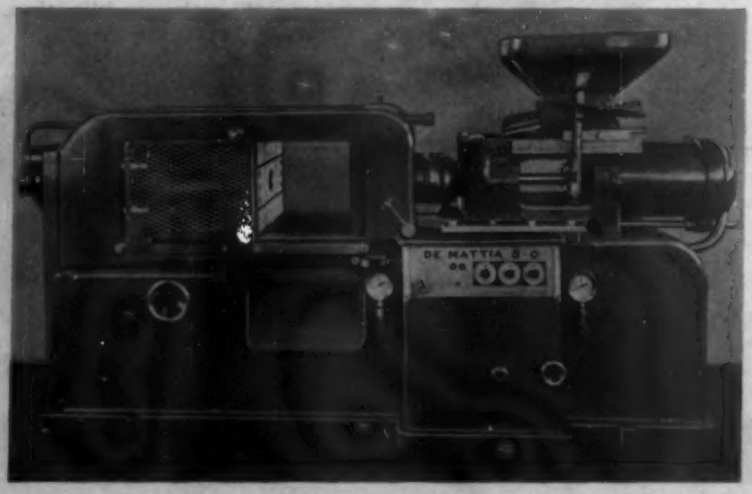
● Safety and simplicity are features of the Grove Chexflo valve, designed and developed by Grove Regulator Co., Oakland 8, Calif. Operation is effected by a synthetic rubber tube stretched over a slotted cup-shaped metal core which expands to open and contracts to close. This expandable tube closes instantly on balanced flow, prior to commencement of the back flow, with the result that there is never any tendency to establish pressure impulses, shock or water hammer through the flow line. Because of its self-compensating and wear-resistant factors, the unit is particularly suited for handling the most highly corrosive and erosive air, gases or liquids.

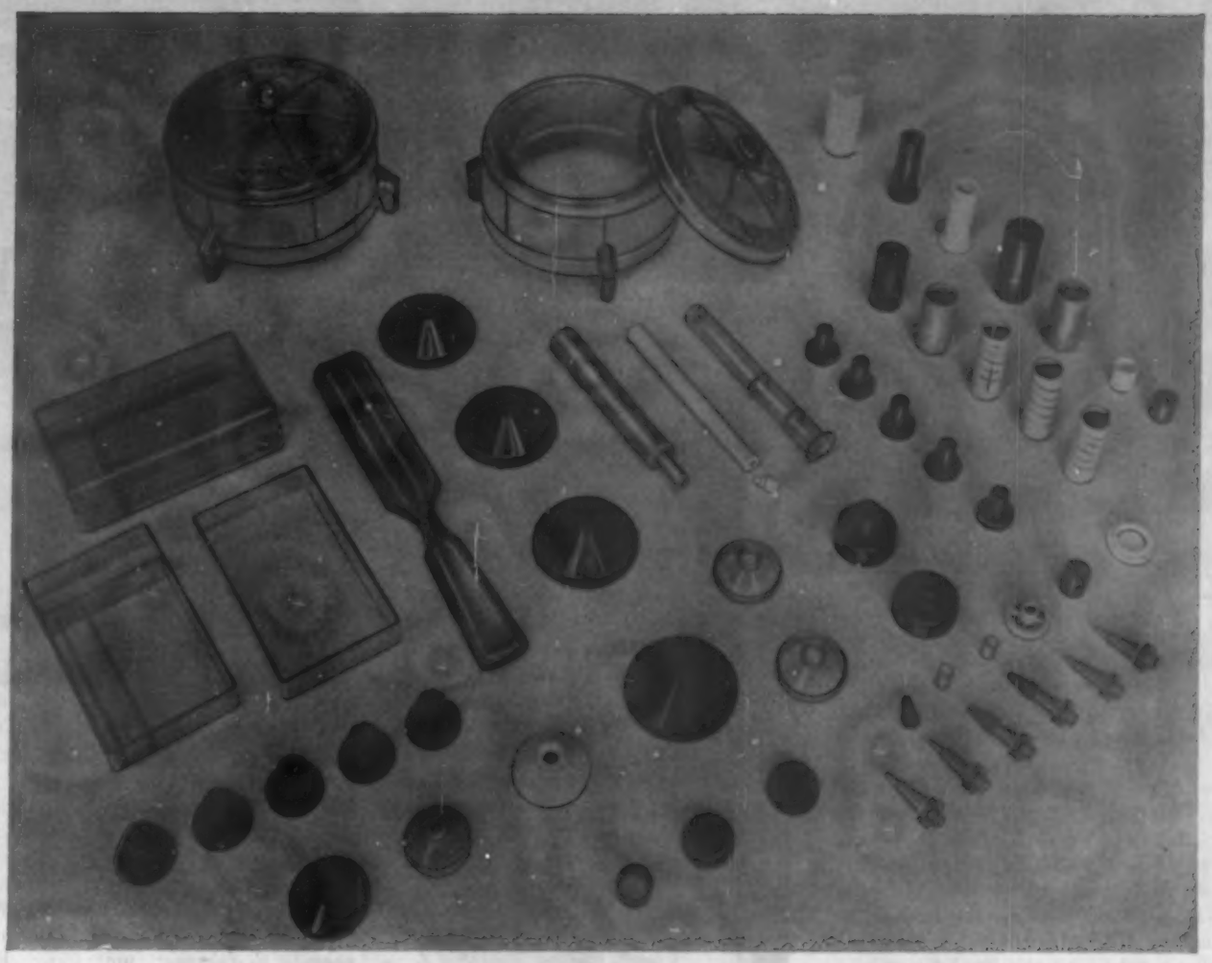
● Newest innovation in Market Forge Co.'s (Everett, Mass.) line of standardized materials handling equipment is the reversible Load-Veyor. The unit is so designed that either side of the conveyor may be used—large packages can be conveyed on one side, small packages on the other. In this latter case the side members act as guide rails. Steel ribbons support the ball-bearing rollers on both sides in a rigid grid-like construction. Removable connectors or couplings are available. The rollers are $1^{3}/_{8}$ by $^{5}/_{8}$ in., furnished with hardened inner and outer ball-bearing raceways, and oil treated to protect them from corrosion and insure efficiency.

● A two-color spray gun which produces unusual finishes has been developed by Sherwin-Williams Co., Cleveland, Ohio. Said to be ideally suited for a variety of metal and plastic products where a finish providing both beauty and durability is desired, Dimenso provides a one-operation finish which is faster and cheaper than conventional hammer and spatter finishes requiring two or three operations. The unit differs only slightly from ordinary spray guns, having an additional fluid inlet near the head to accommodate the second color paint.

● W. H. Nichols & Sons, Waltham, Mass., has announced a power table feed attachment which can be affixed to any Nichols miller now in use with a minimum of work. It need not be attached in the factory but can be done by a mechanic in the field. This feed attachment is said to offer rapid approach, maximum proper cutting feed, fast table return and shut-off. Both air and hydraulic units are variable to suit work being produced. Maximum cutting stroke is 9 in. Unit can be operated from any shop air system having 75 to 175 lb.

● De Mattia Machine & Tool Co., Clifton, N. J., has announced its new 8-oz. all-hydraulic injection machine with a one-piece welded steel base and solid plate frame construction for maximum rigidity. The rolling action patent toggle is made of hardened steel slabs with no pins or wearing parts. The 16,000-lb. machine is said to have an actual clamping pressure of over 400 tons and a controlled pressure up to 3000 lb. Controlled injection speed permits full injection stroke in a minimum of 2 sec. Maximum production is insured by a plasticizing capacity of over 130 lb. per hr. Machines come in sizes up to 24 oz. (*Please turn to next page*)





Injection and Extrusion Moldings

Facilities for producing exceptionally fine INJECTION and EXTRUSION molding.

INJECTION

Simple or intricate forms or parts up to 16 ounces per shot. All Types of Thermoplastics. Facilities for volume production.

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Flexible or rigid RODS, TUBING, TAPES or special shapes in continuous lengths —*"Made by the Mile."*

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PLASTIC PRODUCTS

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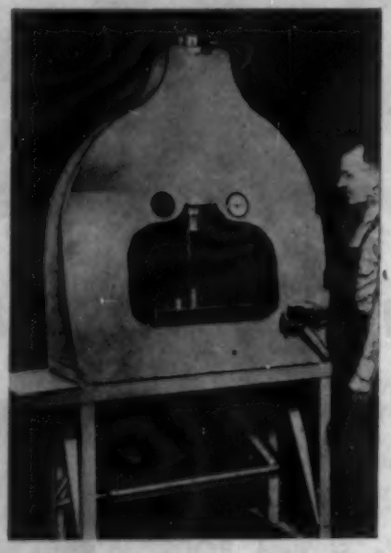
NEW YORK OFFICE—630 FIFTH AVENUE WEST COAST CONTAINER SERVICE COMPANY, LOS ANGELES 11, CAL.

● Allis-Chalmers Mfg. Co., Milwaukee 1, Wis., is introducing the first of a complete line of dielectric heaters—a standard 2 kw. (output) dielectric heater which operates on a frequency of 27 megacycles. According to the manufacturer, the unit employs proved circuits and methods, and its frequency can be varied through a wide range by manipulation of a front panel control. An automatic timer controls heat sequence from 2 sec. to 20 min. as selected. The oven containing the electrodes, which are easily set for any desired application, is completely shielded to eliminate undesirable radio frequency radiation. The filament of a long-life oscillator tube with simplified forced air cooling is protected by a time delay relay and an overload plate current relay.

● Turchan hydraulic duplicating attachment, a development of Turchan Follower Machine Co., Detroit 4, Mich., provides a method of sinking dies by means of a vertical mill when the dies are longer than the mill's ordinary feed travel. The accompanying illustration shows a vertical mill equipped with this attachment being used to sink a die for a plastic instrument panel which measures over 4 ft. in length. Both the model to be duplicated and the stock in which the die is to be sunk are set up between parallels on the table. When half of the die has been sunk, the parallels make it a simple operation to shift the model and stock for the sinking of the other half. This enables an ordinary vertical mill to perform die-sinking operations which formerly necessitated building special machines.

● A new 20-ton motor-driven, self-contained, completely portable hydraulic press has been developed by Northern Tool and Machine Co., Melrose Park, Ill. It is suited for a variety of operations, among which are broaching, forcing, straightening, bending, die try-outs, forming, embossing, assembling and clamping. The manufacturer claims that the massive plate steel frame of the press, which is heat treated to relieve stresses, eliminates all tendency toward distortion by dividing the ram force between both sides of the press. This arch is 14 in. high by 24 in. wide, and the alloy steel platen, 16 by 18 by 2 in., is ground on both sides, drilled and tapped to accommodate all set-ups to capacity of the press. Power stroke is 90 in. per min. and easily adjusted to any length from 0 to 12 in., while tonnage control is effective without retarding speed of the ram. Outside diameter of the ram is 4 in. and when it is fully extended 12 in. remain in the cylinder, thus providing a pilot for ram travel and assuring exactly vertical stroke without side play. The return stroke travel is 120 in. per min. which reduces idle time to a minimum. The pressure control valve is easily set to provide accurate pressure adjustments from 1 to 20 tons and incorporates a self-air eliminating feature, thereby preventing air locks or pulsation and providing smooth steady power.



● Six exclusive features are claimed by Kindt-Collins Co., Cleveland 11, Ohio, for its new 24-in. disk grinder which is adaptable to all types of grinding on metal, wood or plastics. Advantages of the grinder are that the table, which is heavily ribbed, normalized and machined, can be tilted 45° down and 25° up; both faces of the grinding disk can be used; the circular and core print fixture has a capacity of 22 in. in diameter and is wedge-shaped with a 10° angle. The disk will accommodate both flexible back cloth and paper back abrasives. Two models of the grinder are available: Model A, which is furnished with a dust collection system, and Model B, equipped with a 4-in. exhaust tube to be attached to plant dust-collecting system.

● Denison Engineering Co., Columbus, Ohio, has introduced the Multi-Unit—a group of packaged hydraulic press components in compact, unit form. Fully standardized, these units are reported to offer an economical means of installing 4- and 6-ton oil-hydraulic pressure and pressing action in equipment especially designed to meet specific manufacturing needs. Included in these groups are compact and easily moved pumping units in two models, five models of power heads designed for convenient mounting on machinery in positions where their unique pressing actions can be best utilized, or they can be mounted on a standard Multi-Unit frame which permits a variety of positioning arrangements of both pumping units and power heads.

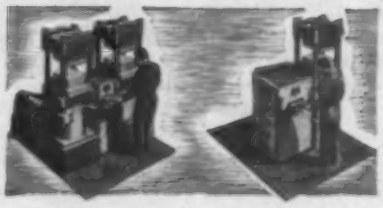
● Features of the model 88x0 Red Head Thermex high frequency dielectric heating unit designed and manufactured by Thermex Div. of Girdler Corp., Louisville, Ky., include large capacity, compactness and ready portability. The unit has a rated output of 5 kw. delivered at approximately 20 mg. and is designed to raise the temperature of 4 lb. of average purpose material 170° F. in 1 minute. Its rapid and uniform preheating qualities are said to shorten molding cycles on preforms as much as 300 percent, to enhance product quality and to reduce the number of rejects. The high-frequency heater is equipped with dual time controls, and is completely automatic.

THE FIRST *LINE*

OF HIGH FREQUENCY HEATING UNITS FOR PLASTICS

IN Thermex Red Heads, Girdler offers more than one exclusive advantage:

A—a complete line from which to meet your particular needs. The range of capacities offered in fully developed, tried and proved Thermex units exceeds anything else in the field.



B—simplicity of installation. From the small model, only 25 inches high, to the biggest unit in the line, every Thermex Red Head is portable. Every one is compact for its capacity and will fit easily into present plant layouts.

C—simplicity of operation. All Thermex units are self-contained, automatic, with the built-in drawer heating compartment. High frequency energy automatically turns on when drawer is closed, automatically turns off when time cycle has been completed.

Mail the coupon or write to one of these Girdler Corporation branch offices—150 Broadway, New York 7, N. Y.; 228 N. La Salle St., Chicago 1, Ill.; 1836 Euclid Ave., Cleveland 15, Ohio.

MODEL X875—400 watt rated output. Will raise ½ pound of average material 170° in one minute. Height 25", Width 15", Depth 30¼".

MODEL 18X0-1000 watt rated output. Will raise ½ pound of average material 170° in one minute. Height 46¾", Width 13", Depth 24⅛".

MODEL 28X0—1500 watt rated output. Will raise 1½ pound of average material 170° in one minute. Height 46¾", Width 28½", Depth 30½".

MODEL 88X0—5 K.W. rated output. Will raise 4 pounds of average material 170° in one minute. Height 79", Width 27⅛", Depth 52".

MODEL 185X—8 K.W. rated output. Will raise 7 pounds of average material 170° in one minute. Height 79", Width 30½", Depth 55".

Thermex* RED HEADS

*Trade Mark Reg. U. S. Pat. Off. The First Industrial High Frequency Dielectric Heating Equipment

THE GIRDLER CORPORATION, THERMEX DIV., DEPT. MP3-46, LOUISVILLE 1, KY.
Please send full information about the complete line of Thermex Red Heads.

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Firm Name & Address.....

.....

News of the Industry

● An experimental knitted Fiberglas cloth for use with low-pressure resins in the production of high-strength plastic laminates and in conjunction with other glass fiber materials employed for plastics reinforcement, has been announced by Owens-Corning Fiberglas Corporation, Toledo 1, Ohio.

● Resinous Products and Chemical Co., Philadelphia, Pa., has announced a new resin, known as Uformite 470, for wet strength improvement of paper. This development is said to represent an entirely new type of urea-formaldehyde resin modification which requires no special handling, aging or pre-treatment before use. The company has also developed a pre-catalyzed urea-formaldehyde resin, Uformite 501, for hot press plywood which permits high extension with flour and thus provides glue line costs said to be as low as those of soybean and vegetable glues.

● Major Edwin L. Hobson, III, has been awarded the Legion of Merit for directing developmental work which resulted in widespread use of plastics in many different military items in World War II. Major Hobson is chief of the Plastics Section, Research and Development Branch, Office of the Quartermaster General.

● Plastic latex made with Geon polyvinyl resins which is now adaptable for impregnation or plain coating of thread, yarn, string and wire is a new development of B. F. Goodrich Chemical Co., Cleveland, Ohio. This technique, somewhat similar to that used with plastic latex in ordinary fabric coating, suggests a variety of uses.

● Continental Can Co., Inc., has announced the discontinuation of operations at their Chicago plastics plant. All plastics operations of this company are now located at Cambridge, Ohio.

● The Packaging Exposition of 1946, to be held in the Public Auditorium, Atlantic City, N. J., April 2 to 5, will be the largest in the 15-year history of the show, according to the American Management Assoc., its sponsor.

● Increase in its plastic business has prompted the Erie Resistor Corp., Erie, Pa., to build a new plastics finishing plant.

● The $61,000,000 expansion program of Westinghouse Electric Corp., Pittsburgh, Pa., will permit an average output more than double that of any prewar year, according to recent announcements made by the company. Part of the new facilities will be used for manufacture of the many new products developed as a result of wartime experimentation and research.

● A new type of laminating plastic, C-5 Resins, has been announced by Bakelite Corp., New York 17, N. Y. The first of these resins, called XJ-17694, is designed specifically as a surfacing for decorative laminates. It is said to give high surface gloss, retain good flexibility, render the laminate highly scratch- and stain-resistant and have good arc resistance.

● Amos Molded Plastics Corp., Edinburgh, Ind., is expanding its injection facilities and has disposed of its compression molding plant.

● W. J. Johnson, formerly with National Rubber Machinery Co., has announced the forming of a new company to be known as Modern Plastic Machinery Co., New York 18, N. Y. The firm plans to carry a standard line of extruders, conveyors, drying systems and granulating machines.

● Ideal Novelty and Toy Co., Long Island City, N. Y., has purchased from the Reconstruction Finance Corp. the former plant of Fairchild Engine & Airplane Corp. in Jamaica, N. Y. The new plant will afford 400,000 sq. ft. of space and will be used for the expansion of the company's plastics department.

● A new plant, which will be devoted entirely to production of Plexon, has been taken over by Plexon, Inc., in Greenville, S. C. It is estimated by the company that a three- to five-fold increase in output of this plastic coated yarn will be achieved in the first year of production.

● Stabilizer V-1-N is a fluid liquid which was developed by Advance Solvents & Chemical Corp., New York 16, N. Y., to prevent discoloration and chemical breakdown of vinyl chloride and vinyl chloride acetate copolymers when processed at high temperatures and exposed to light.

● In the Spring the E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., will start the construction of an addition to its Toledo, Ohio, plant to provide Midwest users of formaldehyde with a closer source.

● Goodyear Tire & Rubber Co., Akron, Ohio, has announced the following expansion plans: creation of a Chemical Products Div. with C. P. Jealyn as manager; construction of a $1,000,000 Chemical Products Div. development laboratory, and construction of a $3,000,000 plant for conversion of vinyl chloride copolymers and other resins into films and sheets.

● Amercoat 59 and 60, two new surface treatment solutions, for use on metals where shot or sandblasting are impractical, have been developed by Amercoat Div. of American Pipe and Construction Co., Los Angeles 54, Calif.

Personnel changes

● JOHN F. SPITZNAGEL, formerly with the Auburn Button Works, Inc., is now vice-president of Murlon Plastics Co., Inc., Rochester 13, N. Y.

● JAMES MORTON is the new sales manager for Croasdale & deAngelis, Inc., Upper Darby, Pa.

● ROBERT H. EVANS, former chief of Pulp Allocation Office of WPB, is now executive assistant to the management of Riegel Paper Corp., New York 17, N. Y.

● W. C. MULLER, former process control engineer on atomic explosive production for Carbide & Carbon Chemical Corp., is now development engineer for Laminated Plastics, Inc., Cleveland 4, Ohio.

● LUTHER J. EVANS, former Chicago Sales representative for the Plastic Div. of Continental Can Co., Inc., is now president of Mayfair Molded Products Co., Chicago 30, Ill.

● JOSEPH A. NEUBAUER is the new technical adviser to Columbia Chemical Div., Pittsburgh Plate Glass Co., Pittsburgh, Pa.

● According to a recent announcement made by General Electric Co., Pittsfield, Mass., WILLIAM D. HAYLON replaces KINGSLEY W. GIVEN as head of the Chemical Dept.'s news bureau. Mr. Given will head the department's lecture bureau.

● WILLIAM HOYT, Jr., formerly in the Plastics Section, Bureau of Aeronautics, Navy Dept., has joined the staff of International Business Machines Corp., Endicott, N. Y. He will act as plastics engineer for all domestic manufacturing plants of the corporation.

● DIMITRI G. SOUSSLOFF resigned his position as development engineer of Celanese Corp. of America to become technical director of Neo Plastics Products Co., New York, N. Y.

molded *Automatically!*

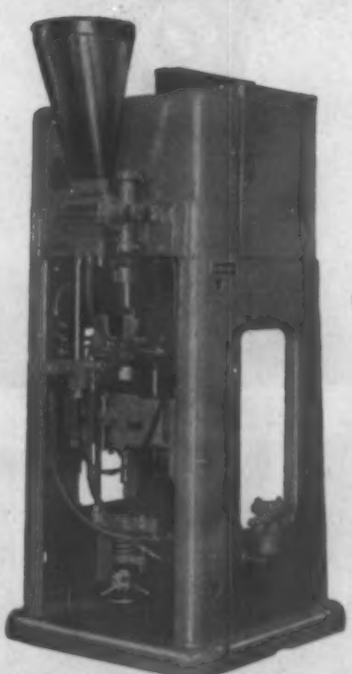
With savings of thousands of dollars per year.....

Caps for a nationally-known brand of pens and pencils used to be molded by conventional methods. The large, multiple-cavity molds needed to hold labor cost per piece within reason produced a year's supply in a few weeks. Result — heavy inventories and large mold investment lying idle.

Now these parts are molded automatically, as needed, on Stokes Presses. The savings in labor costs and inventory total several thousands of dollars per year. *Plus* an "extra" bonus — accuracy is so improved that rejects and time lost in assembly are negligible.

Investigate the demonstrated economies and competitive advantages of Completely Automatic Molding now.

F. J. STOKES MACHINE CO.
5934 Tabor Road Philadelphia 20, Pa.



(Stokes 200-D Completely Automatic Molding Press. 15 tons capacity.)

50th year of Service to Industry

F.J.Stokes MOLDING EQUIPMENT FJS Est. 1895

Laminating identification cards

ALL demobilized service men, from G. I.'s to generals, find it advisable to carry their discharge papers with them for use in making business contacts. But even one copy of an official honorable discharge is a bulky document, subject to considerable punishment from being pushed in and out of wallets and inside pockets. No wonder, then, that these men have greeted with enthusiasm a service provided by photographers in various large cities and in Army separation centers which seals miniature photostats of the discharge papers between thin sheets of Tenite, thus protecting them from stain and wear.

The method used is essentially the same as that developed early in the war for plant identification cards.[1] Both the front and the back of the document are photostated to a size of approximately $3^1/_4$ by $2^1/_4$ in., after which the small reproductions are placed back to back and inserted, two sets at a time, between transparent sheets of cellulose acetate. Several such assemblies are built up into a stack, separated by highly polished chrome-plated steel plates, and inserted between the hot platens of a small Fred S. Carver laminating press.

While one pile of identification cards sandwiched between sheets of cellulose acetate is being laminated a second set is being assembled. As soon as the cure is completed, the operator affixes special holding clamps to both sides of the stack of laminated sheets to facilitate the removal of the work from the press the minute it is opened. These laminated sandwiches of cellulose acetate with paper filler are immediately placed between the bottom or cooling platens and a new assembly inserted in the heating section of the press.

The whole job takes only a few minutes, since cooling time equals cure time, and the press opens at a flick of a lever. As soon as the miniatures of the discharge papers, now sealed between cellulose acetate sheets, are trimmed in a small die machine, they are ready for use.

A similar method of handling military identification cards and important personnel documents has been employed for some time by the Army Service Forces, which recently reported that out of 40,000 officers' identification cards made by one command, there were only 12 rejects. The system is also used in identification of protected and displaced personnel in Europe and in other foreign countries where photographs and fingerprints, along with other information pertaining to the person carrying the card, are included in the single tamperproof molded plastic cover.

[1] "Sabotaging the saboteur," MODERN PLASTICS, *21*, 106–107 (Jan. 1944).

Army discharge papers are photostated in miniature on cards and laminated back to back between sheets of cellulose acetate to protect them and make them more compact

PHOTO, COURTESY CHAS.-STATLER HOTEL

PHOTOS BELOW, COURTESY FRED S. CARVER

Small documents are inserted, two sets at a time, between cellulose acetate sheets. Several of these assemblies are stacked in a pile, separated by chrome-plated steel plates, and placed between the hot platens of the laminating press. Special holding clamps (near left) facilitate transfer of the finished laminates from the press to the cooling platens

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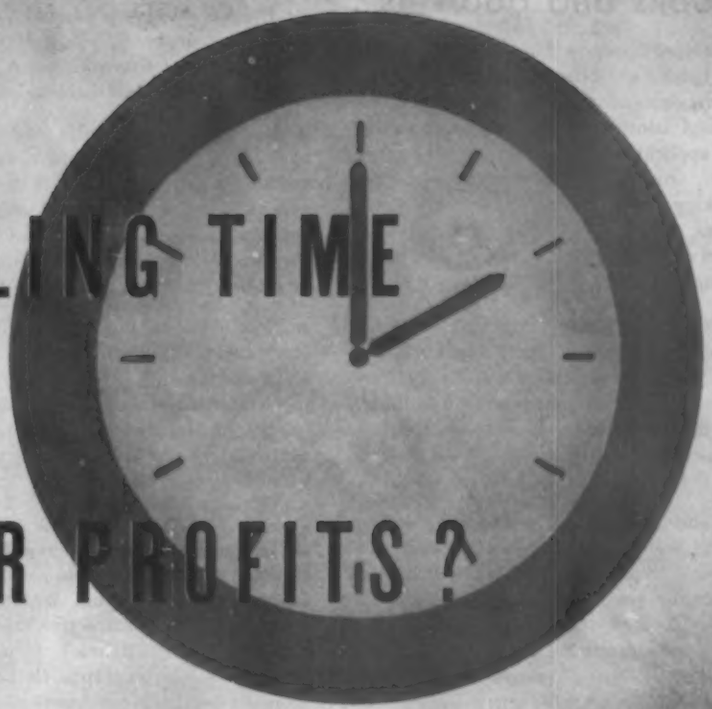

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Books and booklets

(*Continued from page 180*) surement to control, basic control theory, pneumatic mechanisms incorporating control effects, industrial controller applications, controller applications on fractionating columns, controller installations, general checking and testing procedures and others. A glossary of terms and a section on advanced control theory are given in two appendices.

● Cincinnati Milling Machine Co. and Cincinnati Grinder, Inc., Cincinnati 9, Ohio, have just published a profusely illustrated catalog on machines for milling, grinding, broaching, lapping and cutter sharpening. A description and general specifications are given for each machine.

● "The history of packaging during World War II," Report No. 2 covering set up paper boxes, has been released by the Packaging Institute, Inc., New York 17, N. Y. This report is based on authoritative data supplied by the National Paper Box Manufacturers Association, Inc., and is one of a series which, when finished, will constitute a complete authentic history.

● Catalog 370, just issued by the Foxboro Co., Foxboro, Mass., presents a full line of recording and indicating instruments for measurement and control.

● Selection of a material for custom molding or choice of a standard mold is made easier through a booklet published by American Insulator Corp., New Freedom, Pa. The brochure describes possible applications of the various plastic materials, elements to consider in designing, molding methods and comparative properties of materials and includes a catalog of stock molds for knobs, handles, electrical parts and miscellaneous articles.

● Abart Gear & Machine Co., Chicago 50, Ill., has released a pamphlet on gears, including spur, bevel, helical, internal and spiral types, worms, worm wheels, sprockets and finished machine racks.

● Acme Marking Equipment Co., Detroit, Mich., has prepared a catalog of marking equipment which is designed to provide a quick, convenient reference to hundreds of tools and accessories for the marking of plastics, metal, wood, fiber or rubber.

● Now available is the new milling machine catalog H 13 published by Kearney & Trecker Corp., Milwaukee, Wis. Complete information is given in this booklet on the plain, universal and swivel head vertical 1 H and 2 HL milling machines. Standard attachments and accessories for the machines are included.

● The complete line of standard temperature and pressure control apparatus manufactured by Fenwal, Inc., Ashland, Mass., is presented in an attractive brochure entitled "Thermoswitches." Replete with diagrams and photographs, the booklet explains in detail the construction and use of each device. A price list is included.

● Catalog No. 45 on precision production tools released by Acme Tool Co., New York, N. Y., covers but a part of the company's complete line of angles, chucks, flexible shafts, bars, parallels, heads, plates, vises and other precision tools and attachments.

● In commemoration of its 30th year of service, Allied Products Corp., Detroit, Mich., has published an elaborately illustrated brochure describing the facilities of its four plants. The manufacture of fine production tools, dies, jigs, fixtures and plastic molds; hardened and precision ground parts; cold forged parts, bolts and cap screws is shown, along with the firm's processing machines, their specifications and capacities.

★ Bakelite Corp., New York 17, N. Y., takes the reader "Behind the Footlights with Vinylite Plastics" in an attractive four-color booklet showing how that material meets the needs of the shoe industry.

Another booklet, "Selecting the Right Thermosetting Molding Material" which is intended to serve as a companion piece for the company's sound movie, has been published to expand and explain the technical subject matter covered in the film. It provides a study booklet for the foreman, molder, engineer, designer, executive or student of plastics and is fully illustrated with photographs and charts.

★ Complete data on machine tools including drill presses, motors, cut-off machines, grinders, band saws, circular saws, abrasive finishing machines and scroll saws are presented in convenient form in Catalog No. 14 received from Delta Mfg. Co., Milwaukee 1, Wis.

★ Services which Hungerford Research Corp., Murray Hill, N. J., is equipped to offer the small or medium-size manufacturer in the fields of powder metallurgy and plastics are outlined in a booklet that is replete with pictures taken in various sections of their plant.

● An 8-page bulletin on rotameters for measuring flow rate has been prepared by Fischer & Porter Co., Hatboro, Pa. The pamphlet is written in language designed to be comprehensible by the layman. Included are engineering recommendations for the types of units and materials of construction to be used in measuring the flow rates of many difficult and corrosive fluids and gases. The most prominent styles of rotameters and their uses are covered in the text.

Measuring heat distortion

(*Continued from page 164*) the tip of the micrometer and the microswitches. (Any error in the motion of the microswitch is eliminated since both the adjustment and the final contact are made in the same direction.) With all micrometers set back the machine is ready for operation. The main switch and the heater switch are turned on and the test is started.

When any one of the specimens has deflected 0.010 in. the micrometer depresses the microswitch, lighting the corresponding bulb on the panelboard and ringing a bell to attract the operator's attention. The operator notes the number of the unit from the light and the temperature of the oil from the chart and records them on the data sheets after first removing the micrometer from the contact with the microswitch. This operation is repeated for each successive specimen. When all specimens have distorted, the heaters are turned off and water is passed through the cooling coil until the oil is at room temperature and the apparatus is ready for the next batch of specimens.

Advantages of the improved equipment

The advantages of the above apparatus are improvement in accuracy by making all oil-immersed metal parts of Invar, a metal with a very low coefficient of thermal expansion, and by properly aligning and machining the moving parts so as to eliminate or reduce to a negligible amount all frictional effects. The effect of the spring of the dial gage or the microswitch is eliminated by the use of the proper counterweight to make the switch floating and extra sensitive.

The capacity of the machine is about 24 specimens per day as compared to 1 or 2 of the present apparatus. In addition, no attention is required outside of inserting and removing specimens, adjusting the micrometers and recording the temperature at the completion of the test. The latter operation can be made automatic by

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attaching an individual electric timer (elapsed time) to each unit and starting all timers when the heating switch is turned on. When the microswitch of any unit is tripped, the corresponding timer is turned off. At the conclusion of the test the corresponding temperature can be easily read from the controller's chart.

Another advantage is the ease of loading and unloading the specimens since each unit is individually raised above the bath and is kept in any position by the counterweight. There is no danger of burns from hot oil since the machine is brought to room temperature before each loading or unloading operation.

Several sets of weights were made up for this machine so that specimens of any thickness can be easily accommodated at any stress desired. The test can also be conducted in air by insertion of an air jacket around the specimen supports. By using proper oil the unit can be operated up to 250° C., making it possible to handle laminated materials.

The swelling of the specimens may be compensated for by installing a sliding rod, *R*, shown on Fig. 4, over one of the supports and locating a dial gage, *S*, over the top end of the rod. Any swelling or expansion is indicated on the dial gage and can be easily compensated for by proper adjustment of the micrometer. Since the rod is located over the support, no load is added and no error is caused by its addition.

By comparative testing it was found that the new machine gave much more reproducible and uniform results on the sample of the same material than the present single unit tester.

Acknowledgment

The author wishes to acknowledge the assistance of J. A. Gale of the Material Laboratory in preparation of the article, R. R. Winans and Z. A. Bowman for ideas in construction of the unit.

Silicone resin bonded laminates

(*Continued from page 162*) sizing from continuous filament glass cloth, either by heat cleaning or by washing, leaves the cloth so brittle as to be useless for laminating. A scheme advocated by one manufacturer for desizing glass cloth leaves a low but sufficient quantity of silicone oil on the cloth to protect the fibers from abrasion.

This method involves impregnating the raw glass cloth with a solution of one of the more non-volatile silicone oils in toluene to leave about 2 percent of the oil on the cloth. Heat cleaning is then done in an oven in the usual manner. The yarn sizing is burned off but about 0.5 percent of silicone oil remains. Using this method, continuous filament glass cloth was rendered suitable for laminating with silicone resins.

There are now in the process of development several new methods of sizing the yarns for cloth which will make the cloths ready for impregnating directly with silicone varnish, or will require only simple processing.

Processing of silicone resins in the laminating plant offers no new problems. As stated before, the impregnation and drying of the filler stock is done in the conventional manner. Advance preparation of the glass cloth must be suited to the properties desired. The best properties of the silicone-glass laminates are produced when the resin is cured at a high temperature, 250° C. being desirable. The laminator accustomed to making only phenolics or melamine products ordinarily uses steam for heating presses and seldom can go above 180 to 200° C. In such a case, the laminate of silicone resin can be cured in the press at 190° C. for about the same time as needed to cure an equal thickness of phenolic laminate, followed by a heat treatment of the board in an oven at 250° C. It is then suitable for service up to 250° C. (*Please turn to next page*)

Table I.—Effect of Exposure to 250° C. for One Week on Silicone-Bonded Glass Cloth Laminates

Property	*No. 11523 as manufactured*	*No. 11523 one wk. at 250° C.*	*No. 11514 as manufactured*
Flexural strength, p.s.i.			
Flatwise, lengthwise	14,000	18,300	26,800
Flatwise, crosswise	11,800	14,300	20,000
Edgewise, lengthwise	14,200	180,000	...
Edgewise, crosswise	12,000	15,300	...
Tensile strength, p.s.i.			
Lengthwise	16,800	14,000	...
Crosswise	10,500	9,000	...
Compressive strength, p.s.i.			
Flatwise	36,000	34,000	75,000
Edgewise, lengthwise	10,300	10,700	17,000
Edgewise, crosswise	10,000	10,200	16,000
Izod impact, ft.-lb./in.			
Flatwise, lengthwise	13.6	17.0	17
Flatwise, crosswise	9.9	13.3	17
Edgewise, lengthwise	10.1	13.9	...
Edgewise, crosswise	7.5	9.3	...
Bonding strength, lb.			
Lengthwise	1240	1200	1100
Crosswise	920	1150	1000
Water absorption, 24 hr., percent			
1/8 in. thickness	0.63	...	...
1/2 in. thickness	0.32	...	...
Dielectric strength, perpendicular, 1/8 in. thickness, volts/mil.			
Short-time	300	...	...
Step-by-step	225	...	...
Dielectric strength, transverse, kilovolts			
Short-time	40	...	...
Step-by-step	38	...	...
Power factor, 1 mc.			
Dry	0.0015	...	0.0017
Wet, 24 hr.	0.015	...	0.0045
Dielectric constant,			
1 mc. Dry	2.88	...	3.23
Wet, 24 hr.	3.67	...	3.30
Loss Factor, 1 mc.			
Dry	0.0043	...	0.0055
Wet, 24 hr.	0.055	...	0.0149
Insulation resistance, megohms	200,000	...	...
A. S. T. M. arc resistance, sec.	362	...	...
Specific gravity	1.68	...	...

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Table II.—Comparison of Dimensional Stability of Silicone Glass and Phenolic-Glass Laminates

Aging condition	*No. 11523 (silicone)*		*No. 11518 (phenolic)*	
	Width	*Thickness*	*Width*	*Thickness*
	%	%	%	%
160° C., 2 wk.	−0.08	+0.72	−0.27	−2.56
4 wk.	−0.14	+0.22	−0.42	−3.91
8 wk.	−0.33	−0.06	−0.76	− 4.7
16 wk.	−0.58	−0.35	−0.98	− 6.9
250° C., 2 wk.	−0.11	+0.46	−0.27	− 3.7
4 wk.	−0.17	+0.27	−1.01	− 5.0
8 wk.	−0.44	+0.51	−2.6	−14.0
16 wk.	−0.42	+0.15	−2.5	−12.0

The fabrication of silicone-glass laminates is no more difficult than the machining of melamine-glass laminates which most fabricators learned to work during the war. Glass laminates made with silicone resins are flame resistant to a high degree and they will not propagate fire. When burned by a constantly applied source of heat, the products of combustion are quite low in toxic gases such as carbon monoxide.

Tables I and II illustrate the marked resistance to heat offered by the silicone-glass laminates. Two grades are produced by General Electric Co.—No. 11514 made from continuous filament glass cloth and No. 11523 made from staple fiber cloth.

It will be seen from these data that the properties of the silicone-glass laminate are unaffected by prolonged exposure to a temperature of 250° C. For comparison it will be recalled that deterioration of all-organic laminates begins at about 125° C.; of inorganic filled laminates with organic resins at about 150° C., and that their life at 250° C. is a matter of a few hours. (See Table II.)

Possible uses for these laminates

The properties of the silicone-glass laminates suggest numerous applications. The construction of motors for service under adverse conditions calls for heat-resistant insulation. Slot wedges of the silicone-glass laminate together with arching strips, slot liners and terminal boards provide insulation superior to that now used in Class B insulation. Other uses in electrical apparatus can be foreseen where the ambient temperature is excessively high, where the operating temperature becomes high or where a safety factor to take care of overloads should be present in the insulation.

Handles for arc welding electrodes and indestructible insulating parts for other equipment subject to fire hazards are possible. The extremely low dielectric loss factor of the silicone-glass laminates indicates some uses in the insulation of electronic circuits where heat resistance is required. For example, they could be used near the power tubes of modern high-frequency oscillators generating as high as 15 to 30 kw. for induction heating of metals or for capacitive heating of non-conductors, as well as in conventional circuits where the low loss factor alone of these silicone materials offers an advantage over other laminates.

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Resistance of plastics to abrasion

(*Continued from page 168*) 21.2, 17.9, 15.9, 15.7, 14.8. Therefore, new emery must be used for each run.

Effect of angle of impingement—From purely physical considerations it would be expected that the abrasive effect would be a function of the angle of incidence of the emery stream, and that the abrasion would be more pronounced at smaller angles. The data given in Table VI show that this effect was small between 55 and 90° since the haze values went up only slightly as the angle of incidence decreased.

Effect of velocity of abrasive—In Table VII and Fig. 6 are given data relating the abrasive effects on glass, CR 39 and methacrylate to the velocity of the emery particles. It was noted under this type of test that glass began abrading rapidly at higher velocities, that

Table V.—Abrasive Effect as a Function of Distance from Nozzle to Specimen[a]

Distance from specimen	*Abrasive effect (haze) at various velocities*	
	100 m.p.h.	*200 m.p.h.*
in.	*percent*	*percent*
1/8	5.8	22.4
1/4	5.9	20.4
1/2	7.4	20.0
1	15.4	39.6
2	18.9	36.6

[a] Material: CR 39-1
Angle: 90°
Amount of emery: 2.1 g. sec./sq. in.

Table VI.—Abrasive Effect as a Function of Angle of Impingement[a]

Angle	*Abrasive effect (haze)*
deg.	*percent*
55	16.4
60	16.9
65	15.4
70	14.5
75	15.8
80	15.8
85	15.4
90	14.4

[a] Material: CR 39-1
Velocity: 200 m.p.h.
Amount of emery: 2.1 g. sec./sq. in.
Distance: 1/4 in.

Table VII.—Abrasive Effect as a Function of Velocity of Emery[a]

Velocity	*Abrasive effect (haze)*		
	Glass	*Methacrylate II*	*CR 39-1*
m.p.h.	*percent*	*percent*	*percent*
40	1.5	6.7	1.1
100	8.5	21.4	5.9
130	16.4	31.0	9.7
170	32.5	45.3	14.4
210	50.0	55.3	19.2
240	65.3	61.1	23.2
300	82.9	69.8	32.3

[a] Angle: 90°
Amount of emery: 2.1 g. sec./sq. in.
Distance: 1/4 in.

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methacrylate was very sensitive to this test, and that CR 39 was quite resistant, being better at all velocities than either of the other two. The difference between glass and CR 39 may be explained as due to a combination of the higher elasticity of CR 39 and its more complete recovery after indentation. Glass seems to chip after impact, due to its inherent brittleness, whereas CR 39 merely indents and then recovers. However, it should be pointed out that glass is much more resistant to a scratching or horizontal type test than plastics due to its extreme surface hardness.

In the velocity studies the complete range of abrasion was investigated beginning at low haze values and going up to very high haze values. However, in practical applications in glazing, it is not permissible to continue to use material which has acquired a haze of more than about 5 to 10 percent. This is especially true at night where light viewed at small angles is scattered very much and causes poor if not impossible perception of objects. In further experiments the amount of abrasive effect was therefore decreased so that the haze values even at the higher velocities were usually not greater than 8 percent. This was accomplished by increasing the velocity at which the specimen

Table VIII.—The Comparative Abrasion Resistance of Two Plastic Materials and Glass in the Low Haze Range

Amount of emery: 0.21 g. sec./sq. in.

Velocity of emery	*Increase in haze*		
	CR 39-1	*Glass*	*Methacrylate*
m.p.h.	*percent*	*percent*	*percent*
100	0.0	0.8	2.5
150	0.7	2.4	4.0
200	1.3	4.5	9.2
250	2.7	5.2	9.7
300	4.3	9.1	18.4

Table IX.—Reproducibility with the Flying Emery Methods[a]

Specimen No.	*Abrasion effects (haze) caused by consecutive uses of the same emery[b]*				
	1st	*2nd*	*3rd*	*4th*	*5th*
	percent	*percent*	*percent*	*percent*	*percent*
1	20.8	18.7	15.7	16.0	15.8
2	20.8	18.7	15.2	16.0	15.0
3	20.9	17.3	14.6	16.0	15.0
4	20.8	18.5	16.0	16.6	14.2
5	21.0	17.8	16.0	15.1	14.2
6	21.0	17.8	16.0	15.1	14.8
7	22.0	17.8	16.7	15.7	14.6
8	22.0	18.3	16.1	15.7	14.5
9	21.4	17.5	16.1	15.6	...
10	21.4	16.8	16.1	14.7	...
Average	21.2	17.9	15.9	15.7	14.8

[a] Material: CR 39-1
Angle: 90°
Distance: ¼ in.
Velocity: 200 m.p.h.
Amount of emery: 2.1 g. sec./sq. in.

[b] The same emery was used for these consecutive tests on a given specimen and, as explained in the text, its effect became less and less progressively from its first to its fifth use.

It's molding's job to eliminate expensive and time-consuming finishing operations, as for example: the holes in the above panel piece. These could have been drilled in place after the part had been molded — but this would have meant additional cost . . . a possibility of chipping . . . and with both, the certainty of rejects and regrets.

Because of the ingenuity of Consolidated engineers, provisions for the part's 20 vertical holes (top side) and 6 horizontal holes (under side) were made when the mold was being designed and constructed. The processed result: as you see it pictured — a completely finished piece . . . ready to step from the mold to end-use assembly.

Through its years of experience . . . continuously carrying forward a development program . . . always improving techniques . . . Consolidated is qualified to tackle and solve plastics' requirements. When you are faced with a product problem, call upon Consolidated! Our complete facilities are at your disposal. Inquiries Invited!

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passed across the emery stream. In order to obtain exact comparative data, the three materials tested were all attached to the specimen holder and were pulled through the emery stream one after the other in quick succession. The haze values (corrected for original haze) obtained by this method are given in Table VIII. Here, again, CR 39 cast plastic is superior to both glass and methacrylate.

In Table X are presented data obtained on a series of plastics tested under identical conditions.

In order to properly evaluate the results of this work it was necessary to determine the precision of the methods used. In Table IX it is shown that results can be checked to within 5 percent of each other. This is very good for this type of testing.

Acknowledgment

This paper is a contribution from the Research Laboratory of the Columbia Chemical Div. of the Pittsburgh Plate Glass Company. The authors are indebted to Messrs. J. S. Shondel and W. H. Bowers for the experimental work, and to Mr. S. Jolly for his drafting.

Table X.—Abrasion Resistance of Various Plastics

Plastic material	*Abrasive effect (haze)*
	percent
A.S.T.M. SERIES	
Methacrylate I A	53.8
Methacrylate I B	52.7
Methacrylate II A	55.3
Methacrylate II B	51.1
Vinyl chloride acetate	47.1
Polystyrene	80.7
Cellulose acetate H-2	60.3
Cellulose acetate M	60.3
Cellulose acetate S-2	60.3
Cellulose acetate 1224	38.8
Cellulose acetate 1223	42.0
Unsaturated polyester	34.8
CR 39-1	18.8
LAB. SAMPLES	
Methacrylate II C	52.7
Methacrylate II D	56.9
Methacrylate II E	55.7
Methacrylate I C	52.7
Methacrylate I D	51.6
Methacrylate I E	51.6
Cellulose acetate I A	55.6
Cellulose acetate I B	54.6
Methacrylate II F	54.9
Vinyl chloride acetate	53.5
Cellulose acetate I C	37.4
Cellulose nitrate I	48.3
Cast phenolic	38.6
Cellulose nitrate II	48.9
Methacrylate 4-5 A	47.9
Methacrylate 4-5 B	46.9
CR 149	23.7
CR 39-1	18.8

* Velocity: 200 m.p.h.
Distance: 1/8 in.
Angle: 90°
Amount of emery: 2.1 g. sec./sq. in.

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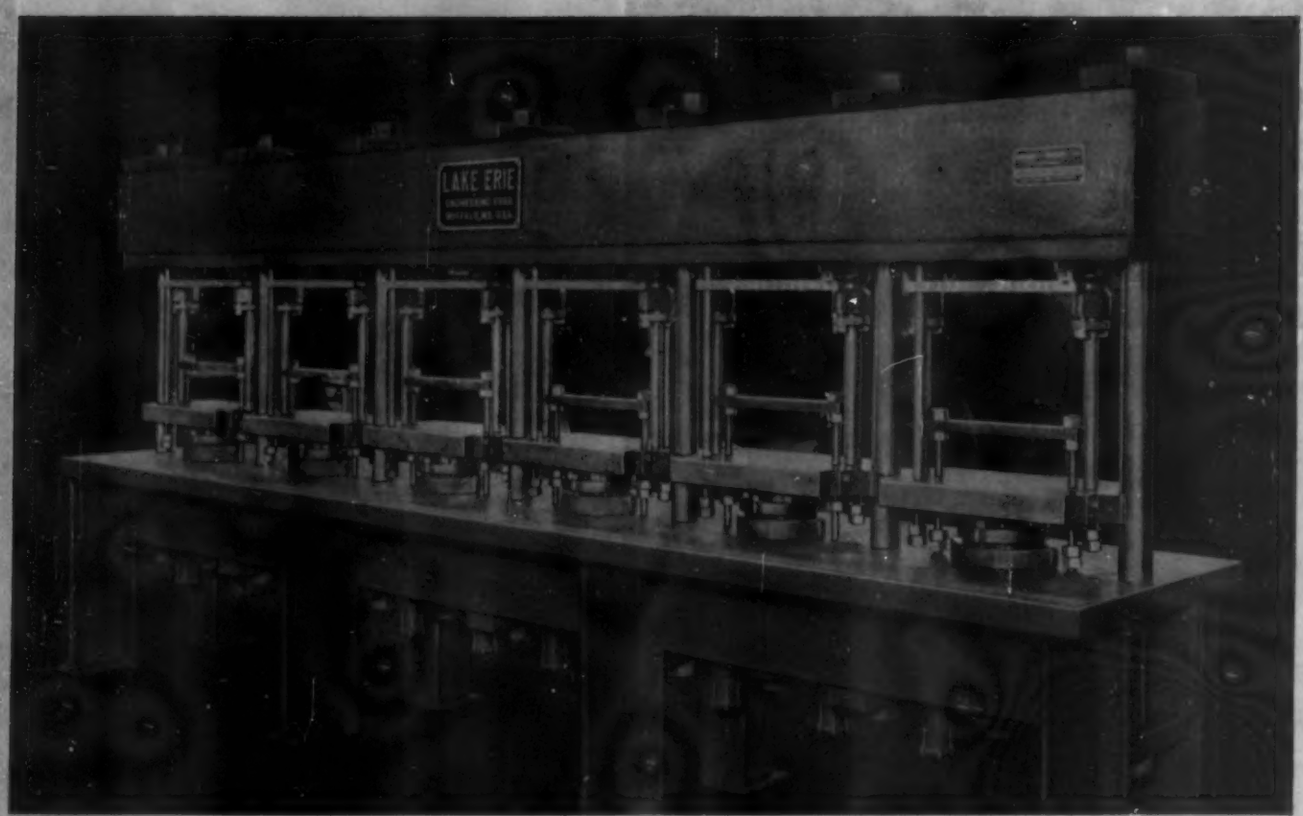

THE six ways to boost production actually boil down to one simple way—get yourself a 6-in-1 Lake Erie multiple molding press. Companies already using this "production multiplier" report that it really does the trick. Designed for one man "progressive operation," the press reduces lost motion to a minimum and production output to a maximum. Some molders have installed banks of 6-in-1 presses, so are benefitting several times over.

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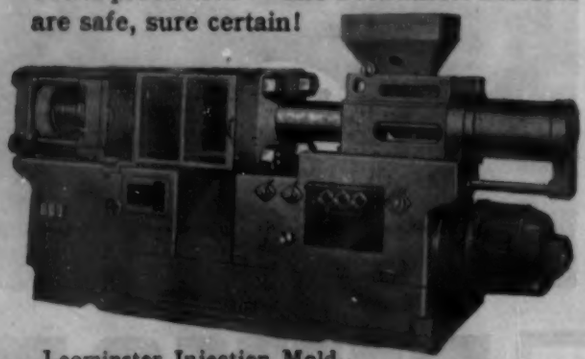

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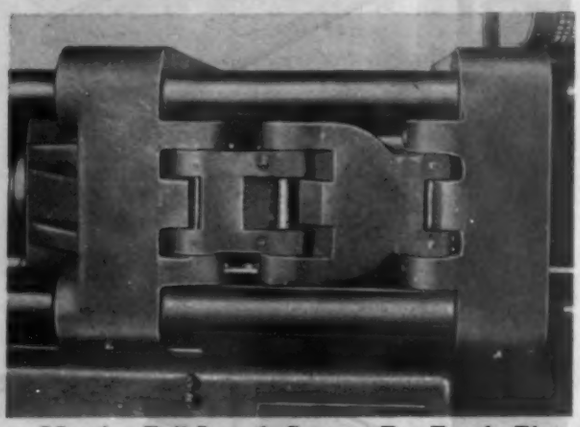

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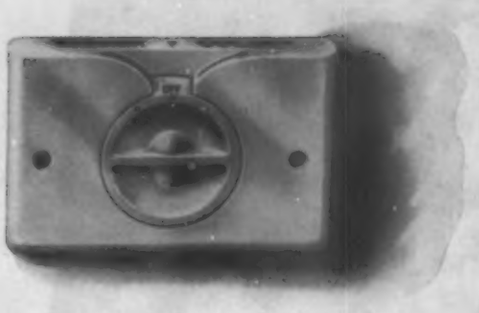

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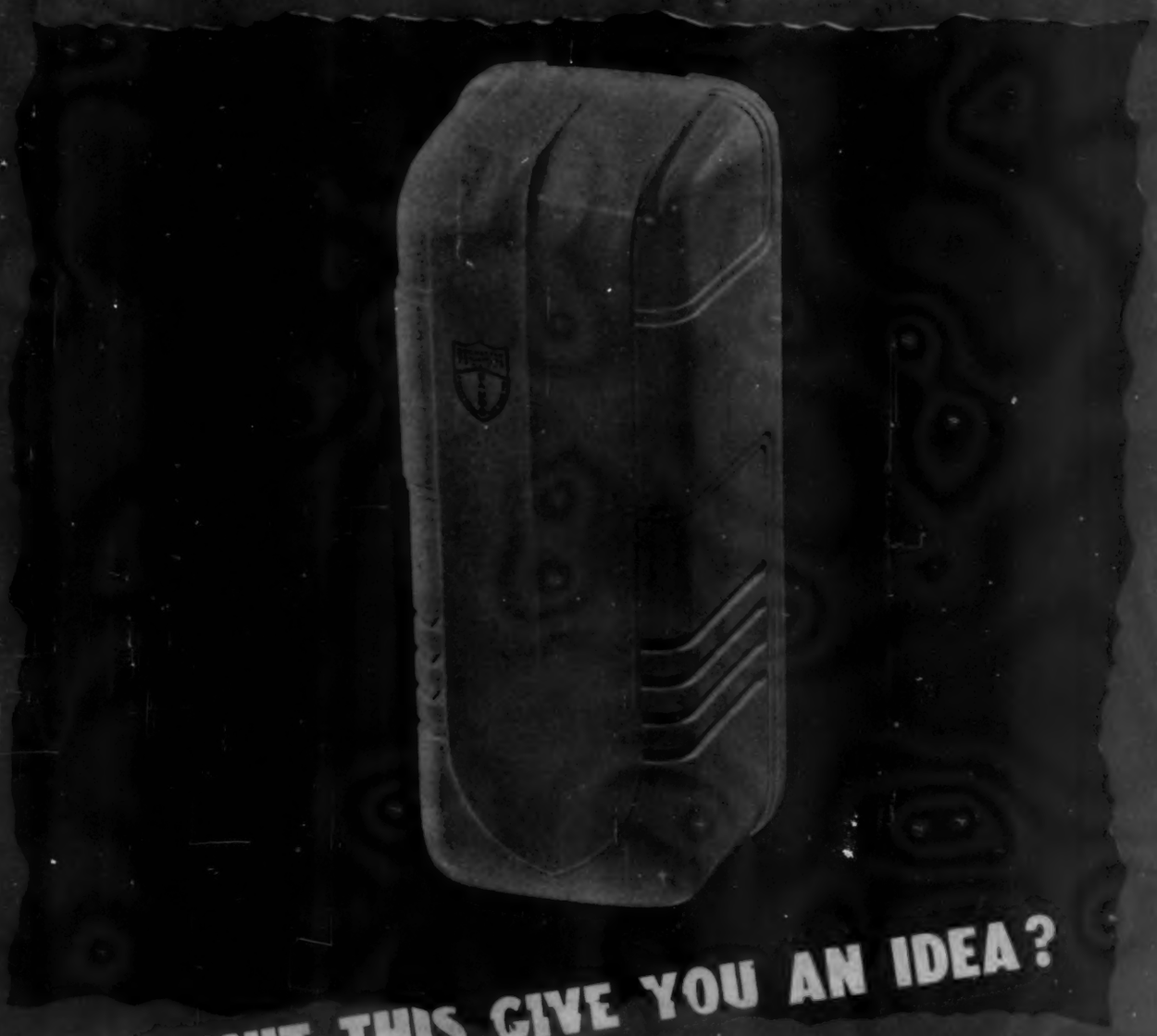

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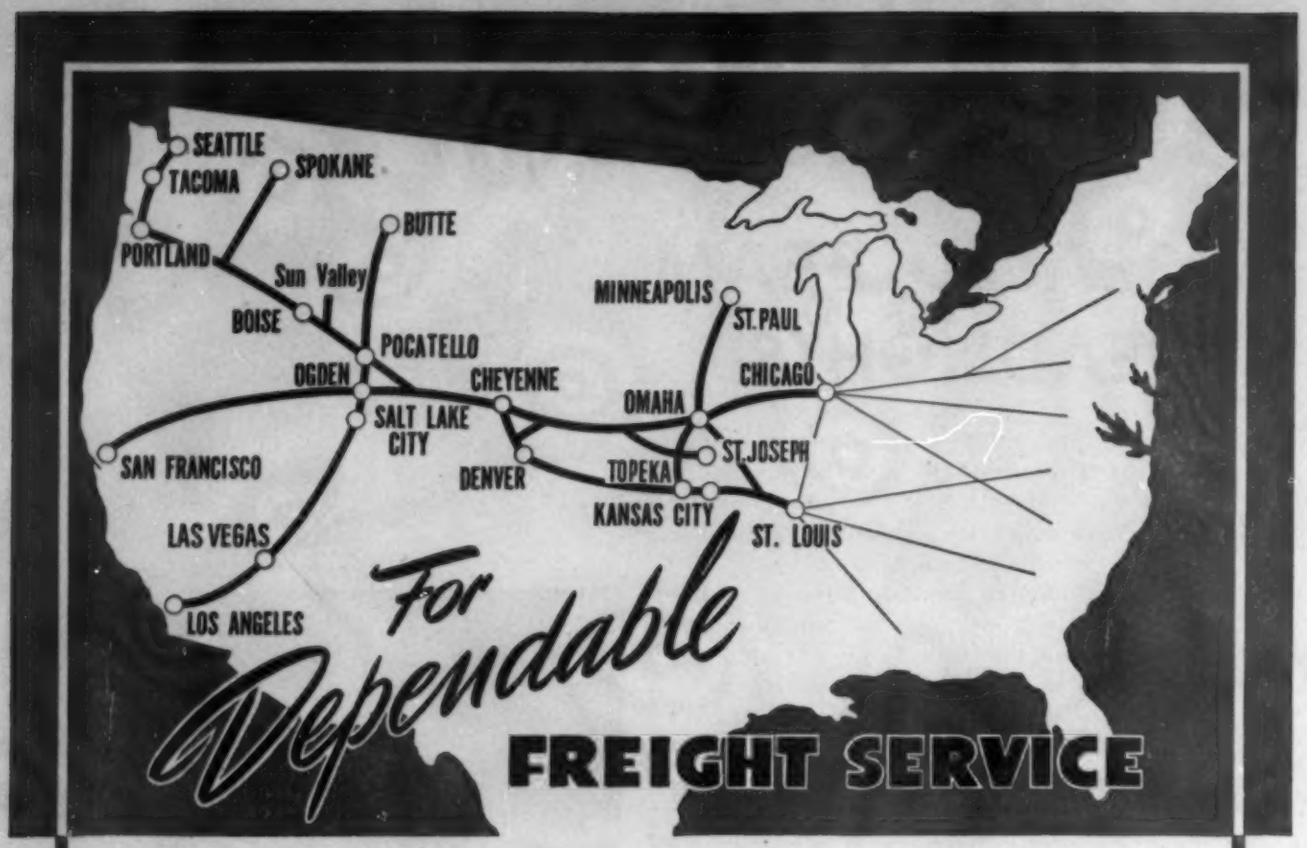

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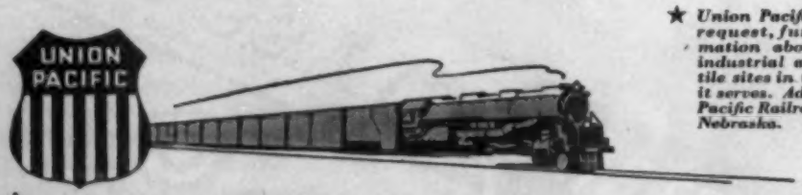

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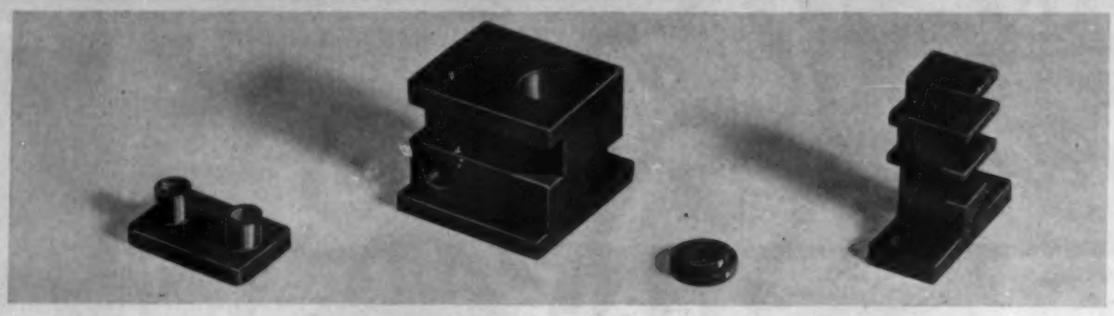

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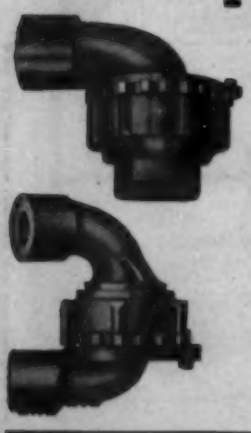

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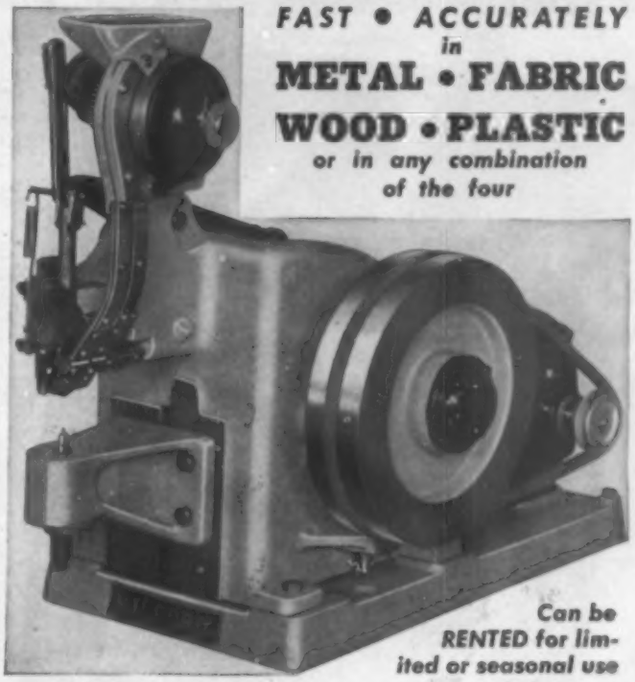

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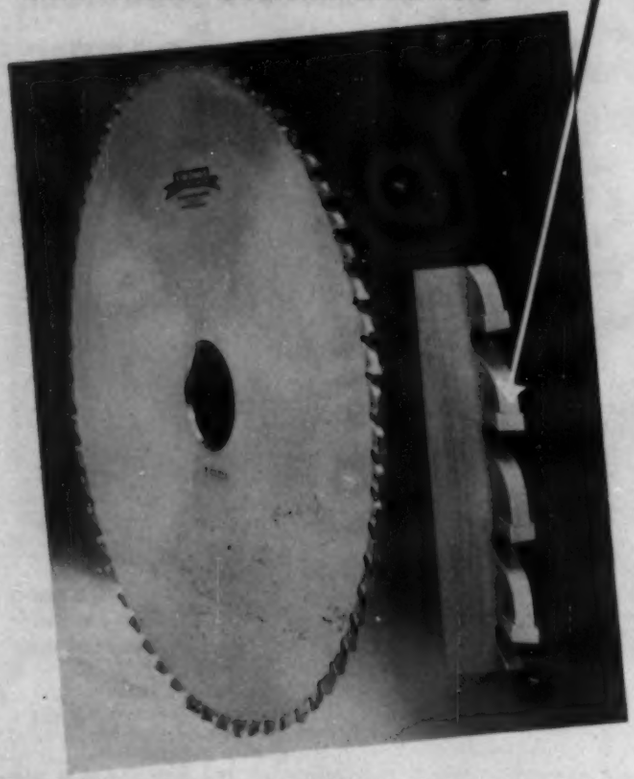

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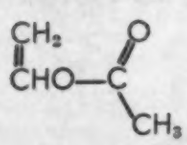
Plastic Finishing
CORPORATION
3651-53 W. ARMITAGE • CHICAGO 41, ILL.

UNPOLYMERIZED

VINYL ACETATE

(STABILIZED)



Boiling Range 71.8° to 73°C.

Vinyl Acetate can be polymerized to form resins with exceptional bonding qualities for wood, glass, metal and fibre

Containers:—

410 lb. drums; 62,500 lb. tank cars

For further information write to:

NIACET
CHEMICALS DIVISION
UNITED STATES VANADIUM CORPORATION

Sales Offices
924 Niagara Building • Niagara Falls, N. Y.

thermoplastics scrap BOUGHT

reconditioned molding powder SOLD

SELL US YOUR THERMOPLASTIC WASTE. *Sell us rejected molded pieces or obsolete molding powders—cellulose acetate, cellulose aceto-butyrate, polystyrene, methyl methacrylate, or polyvinyl resin.*

WE SEPARATE ALL CONTAMINATIONS, *removing steel or other mixtures—metal or anything else—and rework and plasticize the material into first class, ready-to-use reprocessed molding powder.*

BUY FROM US *when reconditioned molding powder is needed for your process. You'll find our product a trustworthy and reliable element. Contact us at our modern plant. Inquiries will receive prompt attention.*

A. BAMBERGER
plastic materials

Call or Write
Department M.
44 Hewes St., Brooklyn 11, N. Y.
Evergreen 7-3887
Cable: Chemprod

FINISH THESE SHAPES
BETTER! FASTER!
with a SCHAUER VACUUM CHUCK SPEED LATHE

De-burr, polish, finish plastic and metal parts this speedy way. Rotate the part, instead of bringing it against a revolving abrasive or polishing wheel. Insure accuracy, evenness of finish, uniformity of polish, speedier production!

Write for Speed Lathe Catalog 440, showing and describing a complete line of heavy and light-duty polishing, de-burring and finishing lathes. What is your finishing problem?

SCHAUER MACHINE CO.
ORIGINATORS OF TODAY'S
SPEED LATHES
POLISH · DE-BURR · LAP · FINISH

2065 READING RD. · · · CINCINNATI 2, OHIO

WE BUY, SELL, PROCESS

PLASTICS SCRAP

ACETATE · BUTYRATE · VINYLS · POLYSTYRENE · ACRYLICS

H. MUEHLSTEIN & Co. INC.

122 EAST 42nd STREET, NEW YORK 17, N. Y.

LOS ANGELES: 1431 E. 14 St. · MEMPHIS: 44 W. Virginia Ave. · CHICAGO: 137 So. La Salle St. · AKRON: 250 Jewett St. · BOSTON: 31 St. James Ave.

Better, Faster DRYING AND CURING at Low Cost

Uniform Dehydration with Nalco Dritherm Infra-Red Lamps

Speed up cycle time and reduce molding problems by controlled dehydration and preheating of molding compounds with Infra-Red Heating — the efficient, penetrating, radiant heating process.

Above — Typical installation of Nalco Dritherm Infra-Red Lamps in conveyor oven. Dropped door shows resins on conveyor being dehydrated by lamps above.

Nalco Lamps are available in inside-silvered, self-reflecting or clear glass types.

Send for your free copy of "Drying Problems Made Easy"

NALCO INFRA-RED DRITHERM

NORTH AMERICAN *Electric Lamp Co.*

1068 Tyler St. St. Louis (6) Mo.

SET A KWIXSET *Automatic* TIME LIMIT SWITCH

. . . and you're set for the closest control of your machines or processes

Just turn pointer toward the right, to time-interval desired. This winds the exclusive Thompson spring-motor. Red light turns off . . . and flashes on again at end of time, signalling the operator. Spring motor automatically throws an improved electric snap switch to operate the light. Just connect to 125 volt circuit, AC or DC, any cycle.

KWIXSET is widely used for accurate time-control of machines and processes in plants producing electrical equipment, plastics, chemicals, textiles, glass, paper, . . . also in laboratories, laundries and plating plants. Easily installed on your equipment . . . *or built into your product.* Write.

7 different dials give time-range of 5 seconds to 24 hours.

H. C. THOMPSON CLOCK CO.

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Plastic Marking

IN GOLD, SILVER OR COLORS

Small Designs, Trade Marks, Names, etc.
Clean-cut precision markings on plastic parts at production speeds up to 1,000 per hour, using unskilled operators. Send samples and details of your stamping problems.

Kingsley GOLD STAMPING MACHINE CO.

★ HOLLYWOOD, CALIFORNIA ★

Precision-Built

PLASTIC MOLDS

INJECTION, COMPRESSION, OR TRANSFER TYPE

1 Our customers (list on request) include many of America's most prominent molders.

2 In our organization are nationally-known authorities on plastic molds and molding.

3 Expanded facilities insure prompt delivery. Your inquiry will receive immediate attention.

esc Engineering Specialties Corporation

3476 Gibson, Detroit 1, Mich.

No 1

Lessons in PLASTICS

Thorough knowledge of the characteristics and properties of thermoplastic materials is the first requisite of a capable plastics molder.

Continental Plastics Corporation designers and engineers are proven experts in this art. It is but the first of many steps in which Continental personnel and craftsmanship excel for turning out the perfect, finished plastic product.

Industrial engineers and manufacturers who have plastic projects in mind will do well to consult Continental service before placing their order. There is no special cost or obligation.

NOW is the time to send or bring in blueprints or sample product.

cpc

CONTINENTAL PLASTICS CORPORATION

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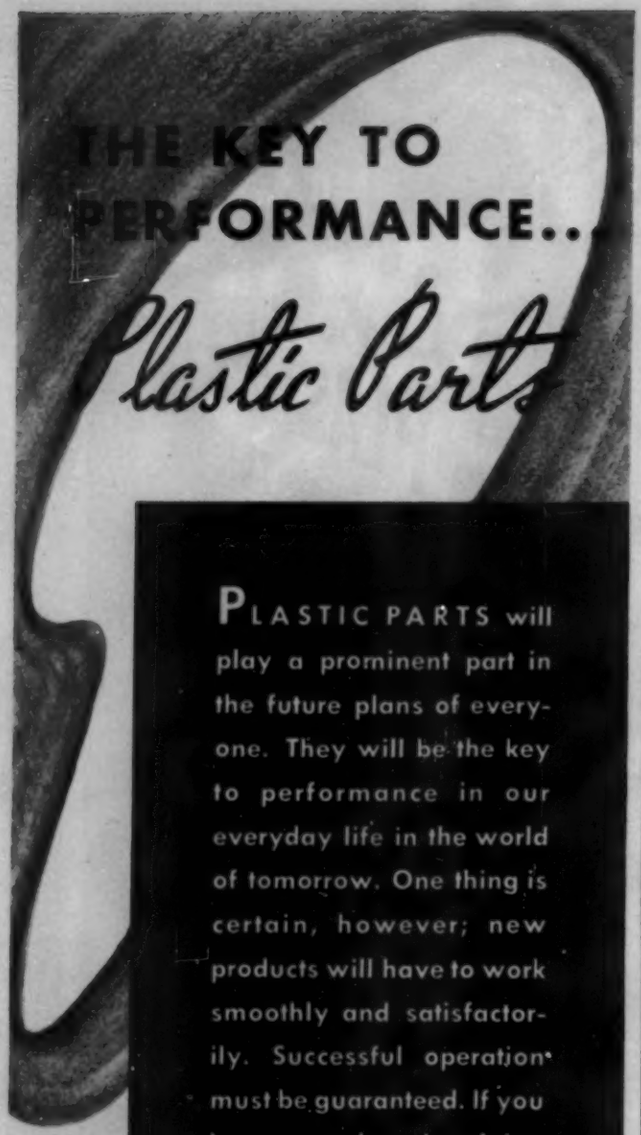

PLASTIC PARTS will play a prominent part in the future plans of everyone. They will be the key to performance in our everyday life in the world of tomorrow. One thing is certain, however; new products will have to work smoothly and satisfactorily. Successful operation must be guaranteed. If you have any plans involving the use of plastic molded parts, get in touch with Franklin NOW . . . We will be glad to talk things over with you.

ARMY E NAVY

Franklin

FRANKLIN PLASTICS DIVISION
Robinson Industries, Inc. - - FRANKLIN, PA.

Pearl Essence

Special types have been developed for use with

Cellulose Esters (Acetate, Butyrate)
Cellulose Ethers (Ethyl Cellulose)
Vinylites (All types)
Acrylates (Lucite, Plexiglas)
Polystyrenes

MEARLMAID PEARL ESSENCE

THE MEARL CORPORATION
153 Waverly Place New York, N.Y.

PLASTIC MOLDS

25 years experience in designing and building molds for leading molders.

Our plant is modern in equipment for producing the best in molds. Compression, Injection, Transfer.

SOCIETY OF THE PLASTICS INDUSTRY SPI

FORTNEY MFG. CO.
247 N.J. R.R. Ave.
NEWARK 5, N. J.

CIBANITE

A

SPECIALIZED PLASTIC

FOR INDUSTRIAL AND

ELECTRICAL USES

ANILINE
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THERMOPLASTIC
MOLDING POWDER

HIGH DIELECTRIC VALUE
HIGH TENSILE STRENGTH - LOW LOSS FACTOR
LOW WATER ABSORPTION
EXCEPTIONAL ELECTRIC STABILITY
GOOD MACHINING PROPERTIES

Literature available on request

CIBA PRODUCTS CORP., 77 River St., Hoboken, N. J.

NOW IS THE TIME

to start post war planning and working on plastic molded parts Our engineers will be glad to call and discuss any problem having to do with compression or transfer molded parts.

RADIO CABINETS all sizes and other large housings are our specialty

All our molds are made by men with more than thirty years experience. Our engineers offer a similar background of experience. Combined, they guarantee production of highest quality, good looking moldings on the highest possible production basis.

CONSULTATION with our engineers
is yours for the asking.

TRADE MARK

Plastimold, INC.
ATTLEBORO, MASS.

COTTON DUCKS
FOR
LAMINATED PLASTICS

Curran & Barry
ESTABLISHED 1903
320 BROADWAY NEW YORK 7, N. Y.

IDEAL "STANDARD" SCRAP GRINDER *at* GEMLOID Corporation

Ball & Jewell Ideal "Standard" scrap grinders are shown in use at Gemloid Corporation plant, Long Island, New York. Two operators are feeding thermo-plastics scrap and rejects into the specially designed baffled hoppers of these machines. These hoppers prevent injury to the operators and waste of material. Note the interesting set-up. Each of these floor saving, Texrope-driven models is mounted on a special dolly which can be moved to any desired position in the plant. Each machine has a removable bin, is easily taken down for cleaning when colors or formulations of thermo-plastic material are changed.

Other features include outboard SKF bearings, sealed against dirt and dust; solid tool steel knives; sturdy castings. These machines are in use in leading molding plants, extruding plants, raw material plants throughout the country. They are "Standard" for low maintenance, efficient operation.

Send for complete catalog of 13 Ball and Jewell models—a size for every plant and every purpose.

• This is #15 of a series of advertisements showing typical Ball & Jewell scrap grinder installations in the plastics industry.

BALL *and* JEWELL

20 Franklin Street BROOKLYN, N. Y.
Since 1895, Manufacturers of Patent Rotary Cutters

or get in touch with nearest representative

CHICAGO: Neff, Kohlbusch & Bissell. DETROIT: J. C. Austerberry's Sons. LOS ANGELES: Moore Machinery Co. LOS ANGELES & SAN FRANCISCO: Machinery Sales Co. NEW ENGLAND: Standard Tool Co., Leominster, Mass. ATLANTA, GA.: George L. Berry. ST. LOUIS: Larrimore Sales Co. CLEVELAND 22, OHIO: L. F. Willmott, 3701 Latimore Rd. SEATTLE 4, WASHINGTON: Olympic Supply Co. KANSAS CITY, KANS.: Fluid Air Engineering Co. AUSTRALIA and NEW ZEALAND: Scott & Holladay Pty., Ltd., SYDNEY, STOCKHOLM, SWEDEN: Ingenjorsfirman Teknova. CANADA: Williams & Wilson, Ltd., Toronto & Montreal.

HAWAIIAN ISLANDS: Hawaiian Sales Service, P. O. Box 3498, Honolulu, 11, T. H.

We're Part of Your Plans!

. . . if your plans call for *Precision* Fabricators of All Plastics Materials

- Display Signs (various sizes for 101 uses) } beautiful in Lucite!
- Radio Dials } beautiful in Lucite!
- Bushings & Screws
- Engravings
- Fibre & Bakelite Radio Parts Punched
- Instrument Panels
- Bakelite Resistor Boards & Terminal Strips

QUOTATIONS GIVEN ON REQUEST

GREENHUT INSULATION COMPANY
31 WEST 21st STREET • NEW YORK 10, N. Y.

RECTO PLASTICS MADE TO PERFORM

INJECTION AND COMPRESSION *Moldings*

RECTO MOLDED PRODUCTS INC.
CINCINNATI 9, OHIO
MELROSE 6862
DETROIT L. S. HOUSE
3-147 GENERAL MOTORS BLDG. MADISON 5781

PLASTICS

MOULDED TO YOUR JOB

EACH item made in plastics sends forth its own bid for Sales Appeal, Durability and the savings of light weight.

But it's knowing how to use plastics that spells the difference. That's why your work at Magnetic Plastics is custom moulded from the plastics that best withstand the wear their job demands.

Ask us to help you see what plastics can do in your business. Just send photo, sample or specifications, and we'll tell you quickly if it can be made in moulded plastics.

THE MAGNETIC PLASTICS CO.

1900 EUCLID BLDG. • CLEVELAND 15, OHIO

New Additions to our List of

PHENOPREG MB

(MELAMINE IMPREGNATED GRADES)

Phenopreg MB materials are melamine impregnated papers which laminate under the application of heat and pressure to produce decorative surfaces that are abrasion and solvent resistant. These materials merit your consideration in the production of table, bar and counter tops, panels, cabinets, etc. Various types of core stocks can be employed with these grades as surface materials, including wood, phenolic laminates, etc.

MB

New MB grades are listed below:

MB-308	Birchbark pattern printed on opaque white paper base.
MB-309	Brown colored paper base.
MB-310	Light blue colored paper base.
MB-311	Light gray colored paper base.
MB-302	Solid black paper base.

We will be pleased to furnish bulletins and samples on the above grades.

Vinewood 1-8200

FABRICON PRODUCTS, INC.
PLASTICS DIVISION

1721 PLEASANT AVENUE, RIVER ROUGE 18, MICHIGAN

Unit F with K handpiece. 1/8 H.P., 20,000 R. P. M. Other Models from 1/20 H.P. to 1/5 H.P. and up to 22,000 R. P. M. 8 Different speeds, rheostat controlled.

FLEXIBLE-SHAFT TOOL FOR MOLD-MAKING AND MAINTENANCE

ARTCO flexible shaft tools are especially designed and constructed for making molds and maintaining them.

Two interchangeable handpieces, Type K with 3/32" and 1/18" collets—Type H with 3/32", 1/8", 3/16" & 1/4" collets enable user to work with more than 1,000 cutting, grinding, polishing tips.

Foot-operated rheostat allows all speeds between 5,000 R.P.M. and 20,000 R.P.M.

ARTCO is the *only* tool of its kind especially designed for use in the plastics industry. As such, it is used in hundreds of plants. Send for Complete Catalog without charge.

American Rotary Tools Company, Inc.

44 WHITEHALL STREET

BOwling Green 9-4895 NEW YORK 4, N. Y.

STOP . . .

DISCOLORATION

with

V-1-N

The new Stabilizer

Stabilizes
Vinyl Chloride
Plastics and
Coatings against
Heat and Exposure
Discoloration

yields:

Transparent
Colorless
Odorless
Heat Resisting
Films and Extrusions

ADVANCE SOLVENTS & CHEMICAL CORPORATION

245 Fifth Avenue
New York 16, N. Y.

DECORATORS
ON GLASS
AND PLASTIC
CONTAINERS
SINCE 1936
★
4 COLORS
IN 1 OPERATION
—FINEST DETAIL

Anigraphic Process, Inc.
11 BROADWAY, NEW YORK 4, N.Y. • WHITEHALL 3-5253

FOR FABRICS WITH A TOUGH JOB TO DO!

The extraordinary toughness of these monofilaments immediately suggests such uses as upholstery material, luggage, shoe fabrics—textile applications where severe usage is a factor.

SARAN withstands scuffing and abrasion, won't ravel or tatter—isn't stained by dirt, grease, ink, perspiration—needs only a damp cloth to keep it fresh and clean.

SARAN BY NATIONAL is extruded and spooled in the size and color required for every purpose and supplied to mills, braiders and other fabricators. We do no fabricating.

The NATIONAL PLASTIC PRODUCTS *Company*
ODENTON, MARYLAND

LABORATORY Mills & Presses

The EEMCO Laboratory Mill is entirely enclosed, ready to operate. It is equipped with built-in motor, control and variable speed drive. Mechanism readily accessible.

The 12" x 12" EEMCO 42-ton Laboratory Press is furnished with self-contained hand pumping unit, air operated fast closing, steam or electric platens, adjustable opening from 6" to 18".

Both Mill and Press are designed for research, development and small scale production.

Bulletins and additional detailed description on any EEMCO products will be sent on application . . . Early deliveries now.

Sales Representatives

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EASTERN
H. E. STONE SUPPLY CO.
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MIDWEST
HERRON & MEYER OF CHICAGO
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CHICAGO 3, ILL.

MILLS • PRESSES • EXTRUDERS
TUBERS • STRAINERS • WASHERS
CRACKERS • CALENDERS • REFINERS

EEMCO *Erie Engine & Mfg. Co.*
953 EAST 12th ST., ERIE, PENNA.

PEI

Custom INJECTION MOLDED PLASTICS..

A complete service in the development of your plastic parts or finished products . . . from designing and engineering to high speed production on the latest injection molding machines . . . and remember, also, that in our new plant we do all finishing and assembly operations.

Representatives in
DETROIT • PITTSBURGH

Call MEirose 6500

President John O. McWilliams • Vice President Thomas E. Orr • Chief Engineer Elno N. Trump

PLASTIC ENGINEERING, INC.
8506 LAKE AVENUE • CLEVELAND • 2 • OHIO

CAPACITY

Plastic manufacturing is entering a highly competitive era; economical operation is impossible without large scale production — tens of thousands, millions of units —

Capacity of production takes its place with creative imagination and engineering skill as a vital factor in the making of Ideal plastic items!

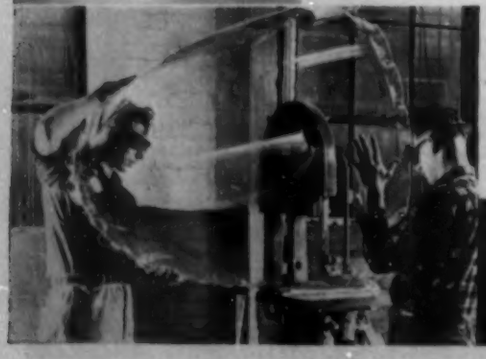
IDEAL PLASTICS CORPORATION A DIVISION OF IDEAL NOVELTY & TOY CO., INC
23-10 43rd AVE., LONG ISLAND CITY, N. Y.

...just the features you would DEMAND if you had them "built-to-order"!

. . . at prices kept low by large volume production.

Left—W-T 15" Drill Press, Bench Model, spindle speed 600 to 5000 R.P.M. with 1740 R.P.M. motor.

Below — W-T 16" Band Saw.



Check! WALKER-TURNER DRILL PRESSES for plastics, plywoods and other laminated materials. Spindle assembly aligned in four ball bearings, with pulleys straddle-mounted between bearings to eliminate whip. Wide speed ranges permit selection of *correct* spindle speed for each material. Hand or power feed, 15" and 20" models. .....

Check! WALKER-TURNER BAND SAW for fast, smooth cuttings. This *one* machine provides speeds from 61 to 5300 s.f.m. —to cut *any* material at its most efficient rate. Ball bearing, rubber-rimmed wheels. Perfectly balanced. Easy operation.

WALKER-TURNER COMPANY, Inc.
PLAINFIELD NEW JERSEY

walker-Turner COMPANY, INC. PLAINFIELD, N.J. U.S.A.

MACHINE TOOLS

DRILL PRESSES — HAND AND POWER FEED • RADIAL DRILLS
METAL-CUTTING BAND SAWS • POLISHING LATHES • FLEXIBLE SHAFT MACHINES
RADIAL CUT-OFF MACHINES FOR METAL • MOTORS • BELT & DISC SURFACERS

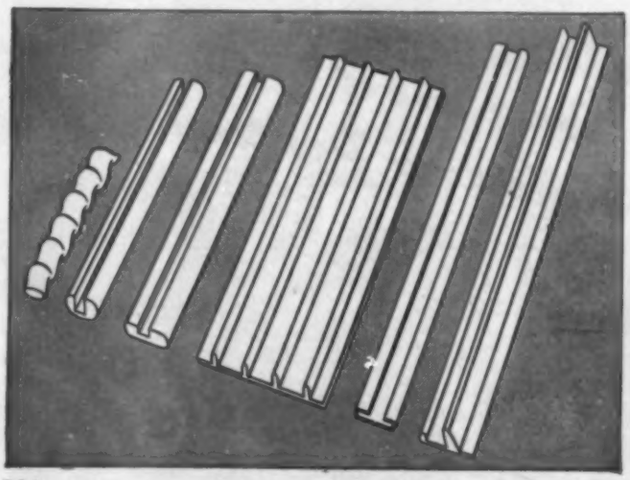
ROBINSON
PROCESSING UNIQUE EQUIPMENT

HAMMER MILLS

Continuous full capacity production. Hard iron, interchangeable grinding plates. Self-aligning bearings. Automatic electro-magnet separator prevents tramp metals from entering grinds. Sturdy construction. Designed by experienced engineers whose reputation is founded upon doing things right. Literature available. Inquiries invited.

HEAVY DUTY TYPE

ROBINSON MANUFACTURING CO.
Plant: Muncy, Pa.
SALES REPRESENTATIVE
MERCER-ROBINSON COMPANY, INC.
30 CHURCH ST., NEW YORK 7, N. Y.



• EXTRUDED THERMO PLASTICS

Shapes • Profiles • Strips • Tubes • Etc.

Made to Order ONLY

AMERICAN PLASTICS CORP.
225 West 34th St. New York City 1, N. Y.

Now

NEW DME ADJUSTABLE THREADED EJECTOR PINS

. . . with ADJUSTMENT RANGE of nearly 2"
DIAMETER 1/4" to 1/2"
ANY LENGTH
IN STANDARD SIZES
STOCKED FOR IMMEDIATE DELIVERY
Easily adjusted by use of mold-makers' standard hexagon key
THREADED SECTION
5/16", 3/8" or 1/2" O. D.

FIRST with standard ejector pins of Nitralloy—now first with standard threaded Nitralloy ejector pins with adjustable range of approximately 2". Heat treated for maximum toughness, ground, polished and nitrided, with welded-on threaded heads of soft steel. True to size—superhard surface—uniformly strong. Mold-makers will appreciate this new ejector pin—another DME-pioneered development—because it costs less and is more uniform than custom-built pins, provides longer life, saves time and labor.

Send for DME News for detailed information with diagrams and sizes.

DME
DETROIT MOLD ENGINEERING COMPANY
6686 E. McNICHOLS RD. • DETROIT 12, MICHIGAN

Farnsworth
TELEVISION & RADIO CORP.
Makes full use of

In its multiplicity of wiring problems the many new and precious features of Surco Spiralon Keyed Insulation, with the widest range of identification in all sizes and lengths, is proving invaluable to Farnsworth Television & Radio Corp. of Fort Wayne, Ind. The ease with which this new insulated wire can be used in small compact areas or in large or intricate installations found instantaneous favor with this famous concern which is taking full advantage of Spiralon's diverse uses.

Spiralon is non-inflammable, non-fogging, non-corrosive, yet flexible and tough; and highly resistant to oils, dilute acids and alkalies to prove ideal for wiring under any and all conditions. Identification stripes are easily seen even on diameters as small as .025. The absence of all pigment fully preserves every electrical property, increases insulating resistance and allows for greater voltage.

With a Nylon jacket added — resistant to high heat and low temperatures — Spiralon further protects all electrical properties, reduces creepage while soldering terminals, offers a higher rupture point than braids and lacquers, checks deterioration, fungi attack, voids and pin holes.

SHIELDED WIRE • VINYL RESIN SHEETING • HIGH FREQUENCY WIRE and CABLE • INSULATING TAPE • INSULATING TUBING

Address Dept. T

SURCO PRODUCT

Surprenant
ELECTRICAL INSULATION CO.
84 Purchase St., Boston 10, Mass.

MOLDS

INJECTION

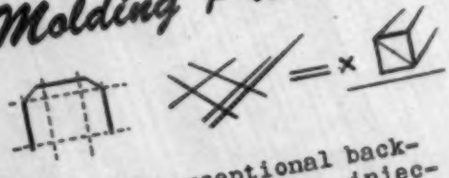
Submit your problems to our experienced engineering staff, equipped to handle your most intricate mold problems.

We design and build automatic molds for many leading molders. Why not let us solve your problems? Our molds are tested before shipping, on our new 16 oz. Lester injection molding machine. 1911 • 1946

STANDARD TOOL CO.
LEOMINSTER, MASS.

N. E. Sales representatives for—
Lester Injection Molding Machines
Ball & Jewell Grinders

Have you a Molding Problem?



We have an exceptional background in compression, injection and transfer molding and can help you decide which process is best suited for your particular work. Our staff knows the advantages and drawbacks of each molding technique and can undoubtedly offer valuable suggestions to save you time, trouble and money. (We also have complete mold-making facilities.) Write or telephone today for our suggestions and estimate.

PLASTICS DIVISION
Allmetal Screw Products Company
33 Greene Street, New York 53 Crosby Street, New York

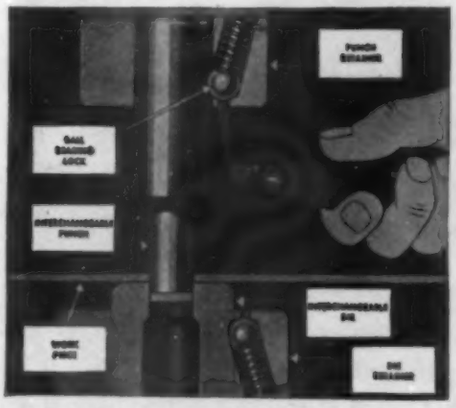
"M. H. Martindell

"can help you with your future plans"

Your plans for the future may be materially affected by your choice of a molder. You need an organization with sufficient equipment and experience to meet every emergency. This type of organization is the kind headed by M. H. Martindell, whose personal experience with every phase of Plastic Molding covers the entire life of the industry itself.

MARTINDELL MOLDING COMPANY
North Olden at Sixth
TRENTON 2, NEW JERSEY
NEW YORK OFFICE—1182 BROADWAY
Plastics PHENOLIC • UREA • CELLULOSE ACETATE MATERIALS

The Original
INTERCHANGEABLE PUNCH AND DIE



Allied's R-B Interchangeable Punch and Die lowers costs in the metal working and plastic industries. Standard punches and dies carried in stock. Special shapes and sizes in any material made to your specifications with prompt deliveries. Send for large illustrated R-B catalog, now.

ALLIED PRODUCTS CORPORATION
Department 29E 4622 Lawton Ave.
Detroit 8, Michigan

COTTON FABRICS
FOR REINFORCING
PLASTICS
★
J. H. LANE & CO., Inc.
250 W. 57th St. New York, N. Y.

GP
PLASTIC MATERIALS

CELLULOSE ACETATE
CELLULOSE BUTYRATE
STYRENE, VINYL AND
ACRYLIC RESINS

A COMPLETE CONVERTING SERVICE

Capacity and supervision that is a guarantee of quality. . . . A reputation for integrity in every phase of Thermoplastic supply.

Headquarters
THERMOPLASTIC
Scrap
BOUGHT — SOLD
or RECLAIMED for You

GERING PRODUCTS inc.
NORTH SEVENTH ST. KENILWORTH, N. J.

SPEED-PRINTZ
Gold Stamping Machine

the name tells the story

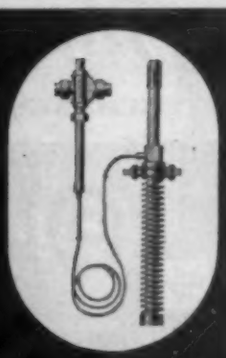
STAMPS NAMES
INITIALS,
TRADE-MARKS
on plastic items.

Send Samples of Plastic for further Information

Immediate delivery

WILSON GOLD STAMPING
MACHINE COMPANY
1855 HILLHURST AVE., HOLLYWOOD 27, CAL.

ACCURATE
DRYING
CONTROL



For simple, inexpensive temperature control of dryers and ovens specify the new

Sarco type KR-14 MD

It is self contained and self operated; requires no compressed air or electricity. The bulb is extra sensitive for quick response in air. Available in sizes ⅛" to 8", Catalog No. 600. 95F

SARCO
SAVES STEAM
SARCO COMPANY, INC.
475 Fifth Avenue, New York 17, N. Y.
SARCO CANADA LTD., 85 Richmond St. W., TORONTO 1, ONT.

specify NORTHERN

It's your custom molder's responsibility. He must make the part right . . . or the product is wrong! When you specify Northern you gain the advantage of more than 37 years of experience in producing plastics for all type assemblies. You are assured of precision and uniformity for your plastic part, which means quicker, cleaner assembly . . . a better all-over job.

Northern INDUSTRIAL CHEMICAL CO.

38 Years of Plastic Molding Experience

7-11 ELKINS ST., SO. BOSTON 27, MASS.

SPECIALISTS

INJECTION MOLDING

THE GROTELITE CO.

INCORPORATED

GRANDVIEW & LAFAYETTE AVE.

BELLEVUE, KENTUCKY

"PIONEERS IN PLASTICS"

ESTABLISHED 1922

---

complete plastic production...

all under one roof

From design through final assembly, experts at Printloid handle your complete plastic job in one plant. You save time and money, insure better design and uniform engineering control. Consult Printloid *first* on your plastic problems.

CASE HISTORY No. 1

Produced as part of the proximity fuse, this Bakelite and Polystyrene assembly employed a combination of Printloid's facilities. It was designed to close tolerances and was milled, drilled, tapped, cut, shaped, sanded, polished and assembled "all under one roof"

FORMING

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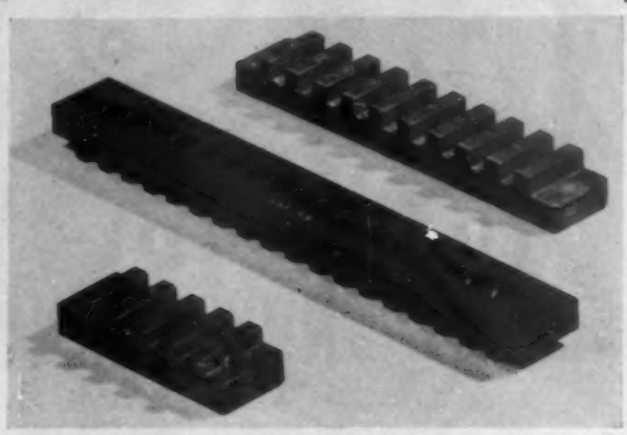

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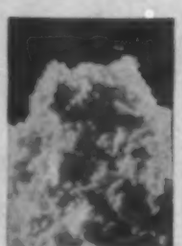

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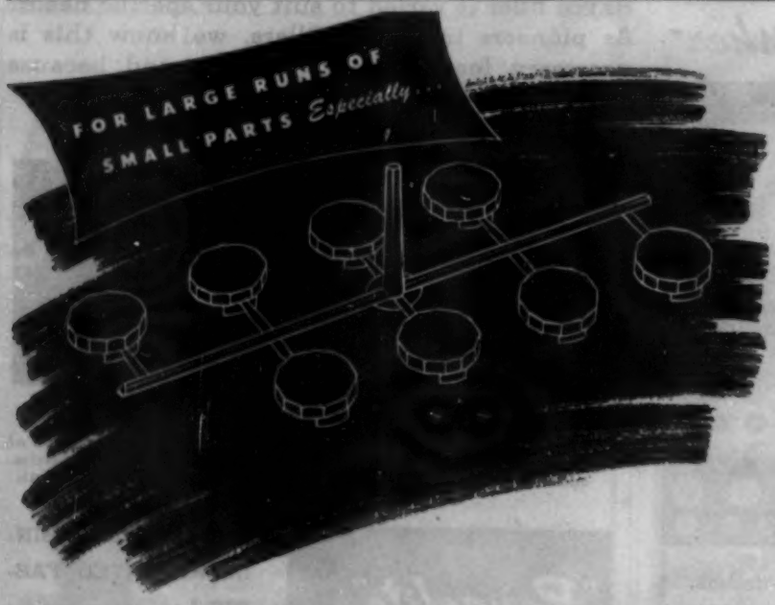

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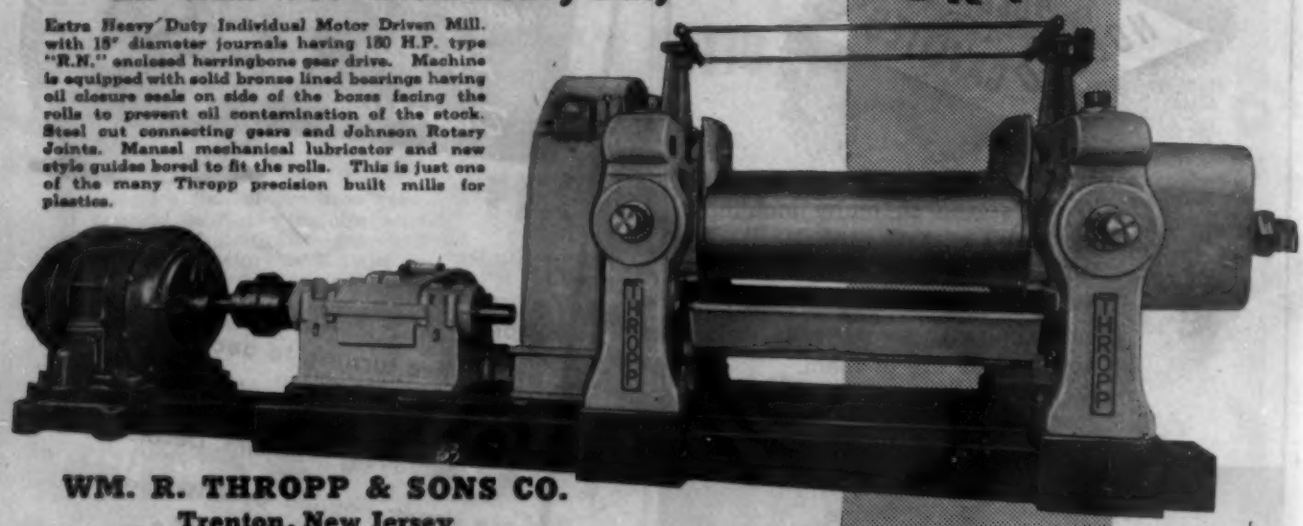

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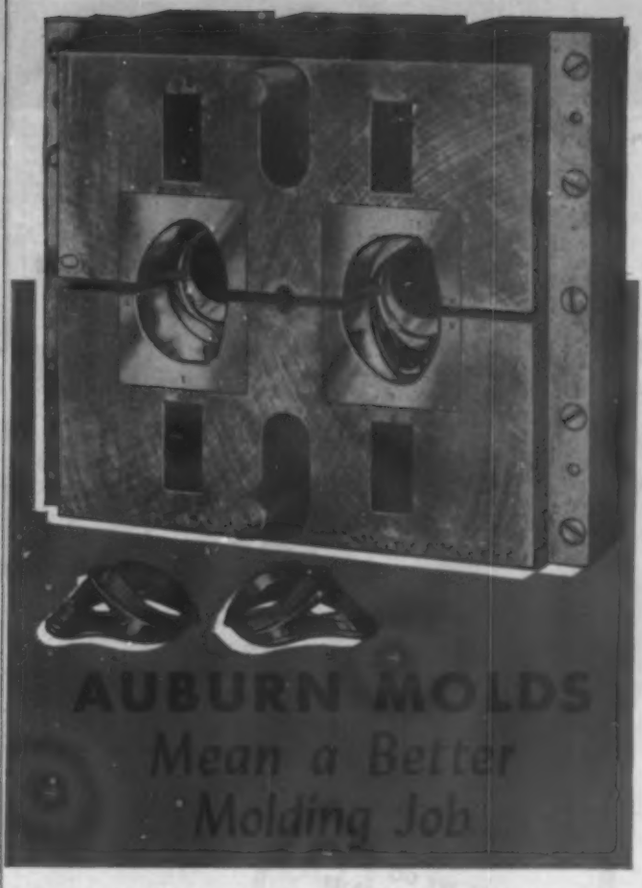

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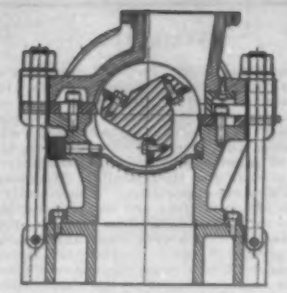

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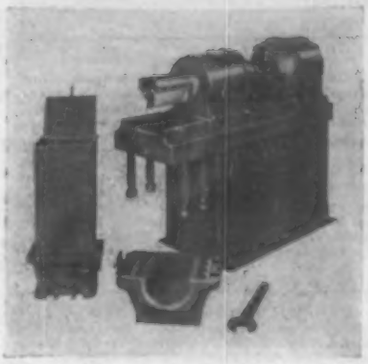

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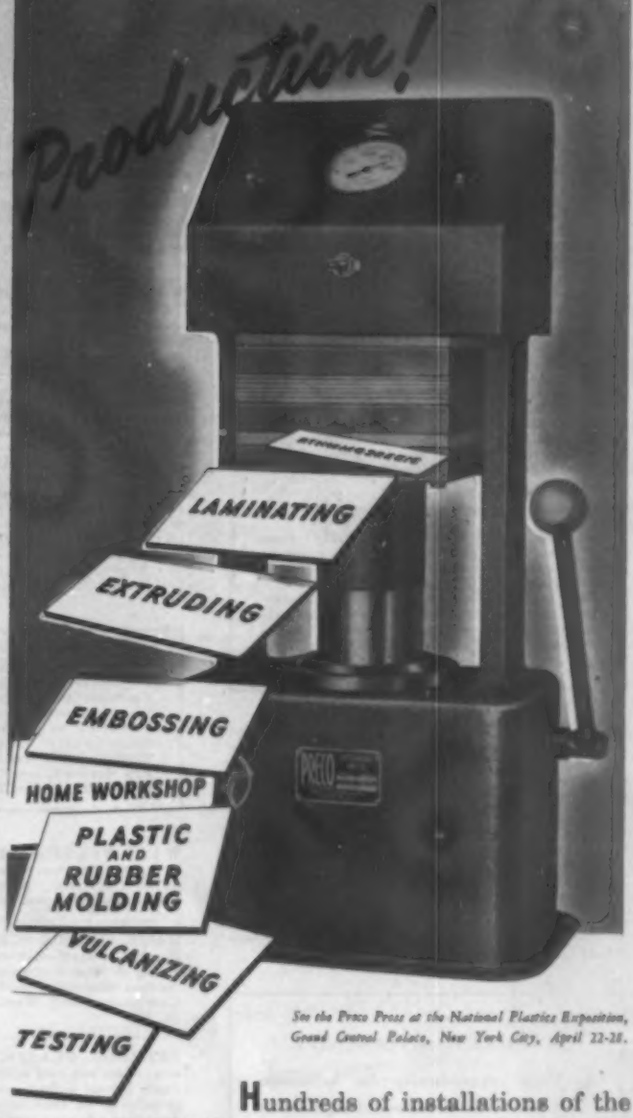

See the Preco Press at the National Plastics Exposition, Grand Central Palace, New York City, April 22-28.

Hundreds of installations of the Preco Hydraulic Press have proved its efficiency for production use. It's fast – accurate – and it's built for hard, rugged service.

The Preco Press features an exclusive two-stage pump – a long stroke for quick action – a short stroke to develop maximum pressure. The press develops a full 40,000 pounds pressure.

Platens are 8"x8" and open 8". They are self-leveling and are equipped with 750-watt heating elements that assure fast heat acceleration. Thermostats accurately control temperature to 600°F. Platens also are equipped with water-cooling coils.

The latest, advanced model Preco Press is available for immediate delivery. Write for Bulletin P102 today for detailed description.

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With experience in the Plastics Field for management of a well established Canadian Plastics Operation, centrally located in Ontario.
Apply with full particulars to Box 1485, Modern Plastics.

SALES REPRESENTATION IN WISCONSIN Experienced salesman desires connection representing manufacturer of plastic items saleable to department, variety and hardware stores; jobbers; building and industrial accounts in Wisconsin. Qualified by education and 18 years' business background. Further information and references supplied upon request. Write details to Box 1484, Modern Plastics.

DIRECTOR OR LEADER
Available on reasonable notice. Desires added responsibility. Ph.D. with nine years of research, pilot, and administrative experience in oils, resins, and plastics. Recognized ability in mechanical ingenuity, cooperation, and in getting results. Would like to organize or expand a testing or research laboratory for a company interested in finding the best materials or processes for its products. Reply Box 1486, Modern Plastics.

SALES MANAGER, presently employed, desires for personal reasons to locate in Eastern area. Extensive experience all phases compression and injection molding, extrusion, and laminating. Exceptional sales and administrative record. Highest references. Reply Box 1488, Modern Plastics.

GENERAL MANAGER for large, well-established company engaged in job and proprietary injection and extrusion molding. Applicant must be top executive experienced in all major business functions, with particular emphasis on sales and production. Salary commensurate with qualifications. Reply must be detailed and contain references in order to obtain appointment for interview. Reply Box 1489, Modern Plastics.

FOREMAN—INJECTION MOLDING. Must know dye set-up. Plant in New York Metropolitan area. Good pay. Excellent opportunity. Reply Box 1490, Modern Plastics.

EXCELLENT OPPORTUNITY

Excellent opportunity for salesman with technical background in plastics industry to sell dyestuffs and pigments to plastics market.

He will cover the eastern United States for a large chemical company. Write details of education, experience, references, and salary required. Reply Box 1491, Modern Plastics.

CHEMICAL ENGINEER PLASTICS—with post graduate training, 3 years as head of "thermoplastics" group in government development laboratory. Has published articles and is well known in the field. Desires supervisory and administrative position in technical or sales organization of progressive firm. Presently engaged as consulting engineer. Reply Box 1487, Modern Plastics.

RADIO CABINET STOCK MOLDS Now available, radio cabinet stock molds, from which immediate delivery of molded cabinets can be made. Address inquiries to International Molded Plastics, Inc., 4383 West 35th Street, Cleveland 9, Ohio. Attention: Plastic Housings Div.

Private individual with extensive background in Plastics Industry desires to purchase outright or controlling interest in presently operating molding company. Sales should be a minimum of $40,000 monthly compression and injection equipment or both. Adequate capital, highest references available. Reply Box 1494, Modern Plastics.

Will pay cash for plastic mold of good adv. Specialty—give particulars. Paramount Calendar Co., 1260 West 4th St., Cleveland, Ohio.

Help wanted—Male. Expert wanted for manufacture of transparent-boxes from Acetate sheet. To open new department in existing firm. Reply Box 1492, Modern Plastics.

WANTED PARTNER PLASTIC SUPERINTENDENT—capable installing new plant with knowledge experience injection compression molding, production equipment, mold design and construction. We are familiar with styling and distribution. We own building midtown New York City, willing to invest $10,000 to $20,000, partner must invest equal amount. Answers held confidential, Interview arranged. Reply Box 1493, Modern Plastics.

COLOMBIAN ENGINEER, trained in the United States and specializing in plastics, wishes quotations on materials and equipment for small scale plastics casting, molding and low pressure laminating. Also interested in representing in Colombia American plastics manufacturers. Excellent references. Reply to: Vicente Uribe, Apartado Nacional 415 Cali, Colombia, So. America.

CHEMIST OR CHEMICAL ENGINEER with resin background desired by eastern company. Must have production or laboratory experience in phenolic or urea molding compounds. Bachelor or higher degree. Excellent opportunity. State qualifications including age, training, experience, salary desired, and include recent snapshot. Reply Box 1495, Modern Plastics.

WANT PLASTICS JOB. Have tested publicity technique. Jack Geddie, 14 yrs. newspaper writing, publicity. Write 967 East 17th Street, Brooklyn, N. Y.

RAGS, FIBER & SCRAP for the Plastic Trade. Plastic coated cotton clippings, Second hand Long & Short staple cotton. Jute-sisal and cotton shoddies and shredded rags. Dry & Company, 1001 West North Avenue, Chicago 22, Ill.

SEEKING PLASTIC FABRICATOR whose organization can turn out in quantity-quality such items as compacts, novelties and varied products at real reasonable prices. Submit samples of your work with prices. If you are interested in year 'round volume contact us at once. HALL-RUSSO, 1110 Cortelyou, B'klyn 18, N. Y.

Have you plastic machining problems? Are your tolerances close? If so, we are set up to take care of your requirements. We fabricate and machine plastic, hard rubber, steel, and copper to .002 or less tolerance, on both small and production quantities. Address questions, inquiries and prints to Box 31, Mechanicsburg, Pa.

NEW PRODUCT OFFERED. Seeking reputable manufacturer to take over patented child's educational device on royalty basis. Item particularly adaptable to plastics. Photographs and working model available. Raymond M. Myers, P. O. Box 1570, Trenton 7, New Jersey.

ENGINEERS serving the plastic industry. Our facilities are now immediately available to you. We specialize in the design of compression, injection, and transfer molds. Dimensional layout or complete detailing.
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62 Beaver St. New York 5, N. Y.
Tel.: HAnover 2-7135

CHICAGO AREA REPRESENTATIVE AVAILABLE in the field for the custom molding of all plastics for the past 16 years. Experienced in the application of engineering and manufacturing principles. Reply Box 1496, Modern Plastics.

East Coast plastic novelties manufacturers doing a nationwide business with chain stores and novelty jobbers, solicits new items or ideas, will buy outright or on a royalty basis; or will handle your items on a percentage basis. Reply Box 1440, Modern Plastics.

GRADUATE CHEMICAL ENGINEER wanted by Los Angeles firm. Training and/or experience with plastic protective coatings, their formulation and application. A working knowledge of solvents, resins, pigments, plasticizers surface preparations, reaction and drying schedules. Give age references, experience training. Reply Box 1497, Modern Plastics.

FOR SALE: Two used hydraulic oil presses, 200 ton capacity, 36" x 36", 12" ram, 36" stroke, 49" daylight. Price $1250. Three new hydraulic Vane type pumps, 5 gallons per min., 2000# P. S. I. 3 new Racine Boosters—2, 4 to 1 ratio; 1, 6 to 1 ratio @ $187.50. Sal-Press Company, 388 Warren Street, Brooklyn, N. Y.

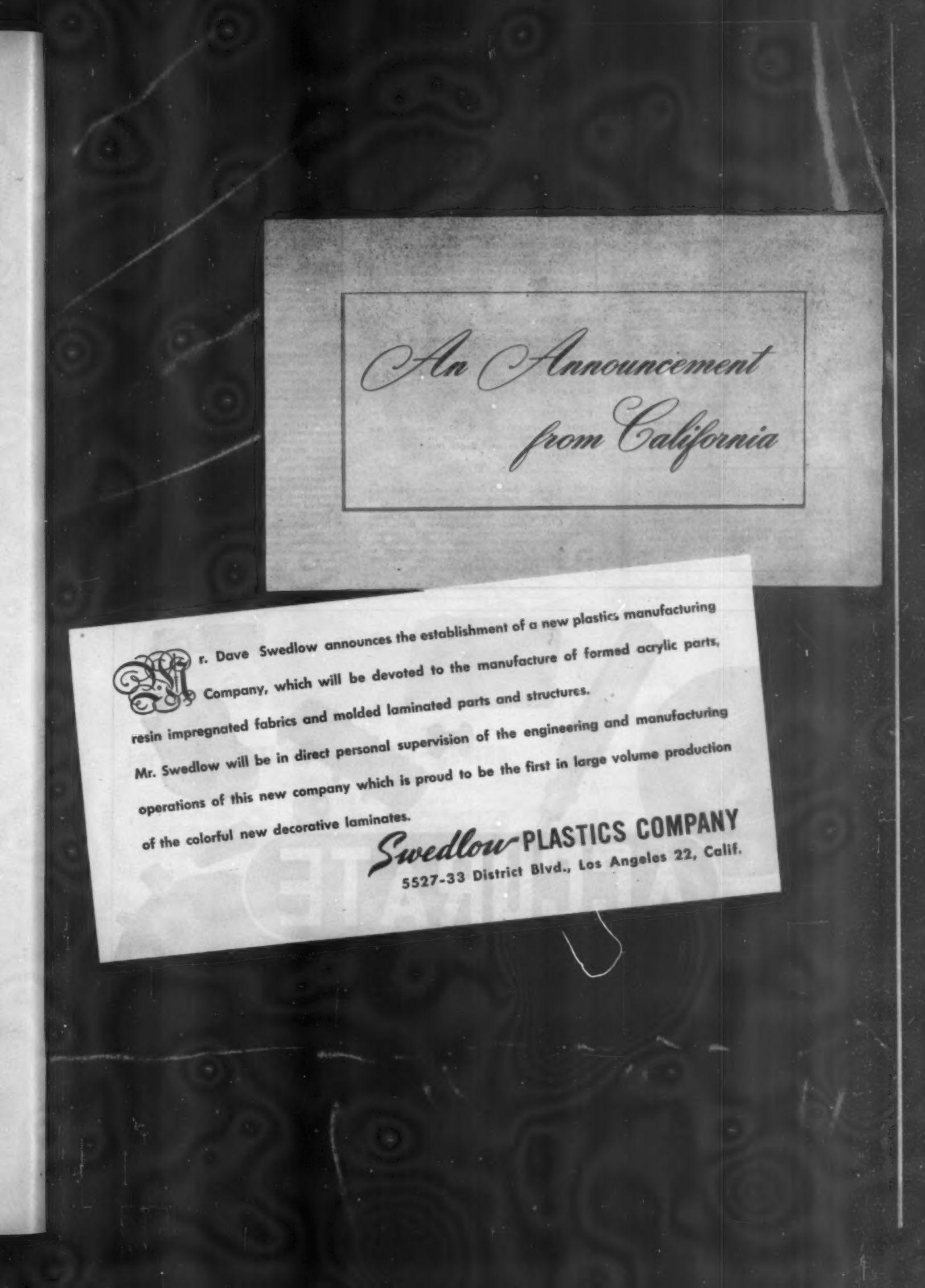
FOR SALE: HPM 500 ton Mold. Presses 42"x 48"; D.&B. 500 ton 42"x48"; Farrel-Birm. 150 & 175 Ton; also 20 to 250 Tons from 36"x36" to 12"x12"; 40 Ton Broaching Press; 400 Ton Extrus. Pr.; W.S. Hor. 4 Plgr. 1" & 2"x4" H. & L. Pressure Pumps; HPM 1¼"x6" Vert. Triplex 10 GPM 2700 lbs.; 2—Oilgear Pumps 13 GPM 1250 lbs.; Wat.-Farrel 1¼"x4" vert. triplex 6 GPM 3000 lbs.; Elmes 1"x4" & 1¼"x4" hor. 4 plgr. 5 to 8 GPM 4500 lbs. & 5500 lbs.; Rumsey 4½"x8" vert. triplex, 65 GPM 900 lbs.; Elmes 2½"x4" hor. 2 plgr., 17 GPM. 850 lbs.; 10 HP horiz. 1¼"x4" triplex 6 GPM 3000 lbs.; New Vickers 1¼" Oil Relief Valves; New Vickers ¾" Flow Control Valves; 2—Adamson 6" Extruders. Hydr. Steam Pumps; Hand Pumps; Low Pressure Pumps 150 to 600 lbs.; Hydr. Accum. Heavy Duty Mixers; Roller Conveyor, Grinders, Pulverizers, Gas Boilers, etc. PARTIAL LISTING. WE BUY YOUR USED MACHINERY. STEIN EQUIPMENT CO., 426 BROOME ST. NEW YORK 13, N. Y. CANAL 6-8147.

POSITION WANTED: Graduate Plastics Eng. age 46. Thoroughly exp. in mold design, planning, research and management. Reply Box 1500, Modern Plastics.

INJECTION MOLDING AND TOOL SHOP CAPACITY OPEN

We have open capacity on four and eight ounce injection molding machines. Also facilities for mold design and construction. Reply Box 1501, Modern Plastics.

FOR SALE: Hydraulic Presses: 600 ton Watson-Stillman double acting downward ram, platen 24" x 24"; 2—self-container, completely automatic 5 tons capacity; 3—20" x 20" 10" rams, 78 tons; 1—24" x 24" 6" ram, 75 tons; 1—24" x 24" 10" ram; 2—24" x 24" 16" rams, 250 tons; 1—24" x 30" 16" ram, 250 tons; 1—30" x 30" 16" ram, 5 openings, 250 tons; 1—20" x 20" 13" ram, 150 tons; 1—26" x 52" 14" ram, 400 tons; 1—20" x 40" 2—8" dia. rams, 100 tons; 4—12" x 12" 7½" rams, 50 tons; 1—13" x 12" 7½" ram, 75 tons; 2—15" x 15" 8" rams, 75 tons. Pumps: 1—HPM Triplex 1½ GPM 2500#; 1—4 plunger 6 GPM 2000#; 1—Robertson Duplex 1½ GPM 4000#; 1—Watson-Stillman 4 plunger box type 3 GPM 4400#; 1—HPM Triplex 1½ GPM 2000# on high 16 GPM 400# on low, V Belt Pulley; 1—Hele Shaw JLP 12, 44 GPM 1200# with new control; 2—Vickers Units 27 GPM 1000#; 1—Gould Triplex 12 GPM 1250#; 1—Elmes Duplex 1.5 GPM 2850#; 1 Watson Stillman single plunger ⅓ GPM 4300#; 4—Stokes 1½" dia. tabletting machines; Accumulators: 1—Watson Stillman hydropneumatic type 1.86 CPS 3500# pressure with by-pass valve; 1—Buckeye high and low pressure tank type, 3½GPS 4000# and 20 GPS 500#; Extruder; Housatonic 6" Extruder; Mills; Calenders, Mixers, Laboratory Presses, etc. HIGHEST PRICES PAID FOR YOUR USED EQUIPMENT. Universal Hydraulic Machinery Company, 285 Hudson Street, New York City 13.


An Announcement
from California
Mr. Dave Swedlow announces the establishment of a new plastics manufacturing Company, which will be devoted to the manufacture of formed acrylic parts, resin impregnated fabrics and molded laminated parts and structures.
Mr. Swedlow will be in direct personal supervision of the engineering and manufacturing operations of this new company which is proud to be the first in large volume production of the colorful new decorative laminates.
Swedlow PLASTICS COMPANY
5527-33 District Blvd., Los Angeles 22, Calif.

HYDRAULIC Presses (Used) Wanted By Laminator
Prefer multiple openings with cooling attachments. Temperature 300°F. Minimum pressure 250 lbs. p.s.i. on platen area. All sizes considered. No dealers. Reply Box 1302, Modern Plastics.

INJECTION MOLDING MACHINE new 8 oz. approximately 15 days (360 hours) per month open time available at reasonable rate for steady run beginning April-May. Submit offer to Box 1496, Modern Plastics.

PLASTICS DEVELOPMENT ENGINEER: Recently returned from Europe after serving as plastics investigator for technical industrial intelligence committee. Excellent background in development of low pressure laminates, cast plastics and low density sandwich construction in aircraft industry. Several years supervisory experience plus previous sales experience. B.Sc.Chem., age 35, married, 2 children. Desires connection in executive, administrative or sales capacity. Reply Box 1503, Modern Plastics.

WANTED: Interest in young plastic concern. Ex Naval Officer—3 yrs. pre-war business experience desires to purchase interest in small plastic fabricating or distributing company. Reply Box 1504, Modern Plastics.

PLASTIC MOLD DESIGNER

Thoroughly capable man who has had experience with the design of all types of plastic molds. Location central New York. Reply Box 1505, Modern Plastics.

FOR SALE
1—Rodgers 2 plunger Oil Pump SGPM 3000#; 3—Vickers Oil Pumps 17 GPM 500 to 1000#; Metalwood Horizontal 4 plunger 1 GPM 3000#; 1—Rumsey Vertical Triplex 300 cubic inches 3000#; 1—Gould Vertical Triplex 24 GPM 2500#; 1—Robertson Vertical Triplex Pump 7 GPM 5000#; 1—Robertson Vertical Triplex Pump 4 GPM 6500#; 2—Gould Vertical Triplex 200 GPM 400#; 1—Elmes Horizontal 4 Plunger 6½ gallons 5000#; 2—Galland Henning Horizontal 4 plunger Pumps 50 GPM 2000#; 2—42 x 42" 14" ram presses; 30 ton Watson Stillman 12 x 12" Laboratory Presses; Hele Shaw variable pressure 33 GPM 2500#; Racine Pumps 30 GPM 1000#; Racine Boosters 3 to 1 ratio; Racine miscellaneous valves; 750 ton Hydraulic Press; W. S. Vertical 2 pl. pumps 176 cubic in. 6900#. Reply Box 1225, Modern Plastics.

FOR SALE—(1) Oilgear pump two feeds adjustable, 2400 cubic inches. Oil displacement up to 1000# P. S. I. type QH-1 x 4. Variable delivery. Price at $400.00. (3) New 75 ton double acting cylinders. 12" stroke, 7" ram with a 4" plunger cylinder is of forge steel with 2" wall. Cost $1500.00 each to make. Asking $500.00. Sal-Press Company, 388 Warren St., Brooklyn, N. Y.

UREA MOLDING POWDER required for immediate and future delivery in ivory, light blue and light green. Reply Box 1499, Modern Plastics.

FOR SALE: Small compression molding plant now in operation. Located in small town in Central New York State with trucking and rail facilities. Buildings and land complete with operating equipment including presses of 150 ton capacity, set up to operate with high speed hand molds with automatic heating and hydraulic supply attached to each individual press. Complete $40,000. Reply Box 1507, Modern Plastics.

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HOUSEWARES PAPER PRODUCTS
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We have three warehouses strategically located from coast to coast from which we ship our own merchandise, sales volume of which is in excess of $5,000,000 a year.
Correspondence invited from reputable manufacturers or individuals who have a product needing intelligent merchandising and development for profitable sales. Interested only in an exclusive tie-up.
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OPPORTUNITY OFFERED for an ambitious young engineer with a background of education and practical experience in drafting. We have opening for one graduate engineer to study plastics engineering, tool design and construction, and new developments in a moderate size plant where opportunity is available to learn all phases involved in the production of plastic items. The future in the plastics industry is unlimited and the opportunity to develop your abilities to the fullest extent is with a moderate size molding plant where you will personally come into contact with all phases of engineering and production.
Please do not answer this notice unless you are interested in making plastic engineering your occupation for life and are willing to devote most of your extra time and thoughts to the future of plastics.
Will you kindly give us a complete accounting of your background of education, practical experience, and personal history so that we may become acquainted with your qualifications to grow up with our organization. Reply Box 1508, Modern Plastics.

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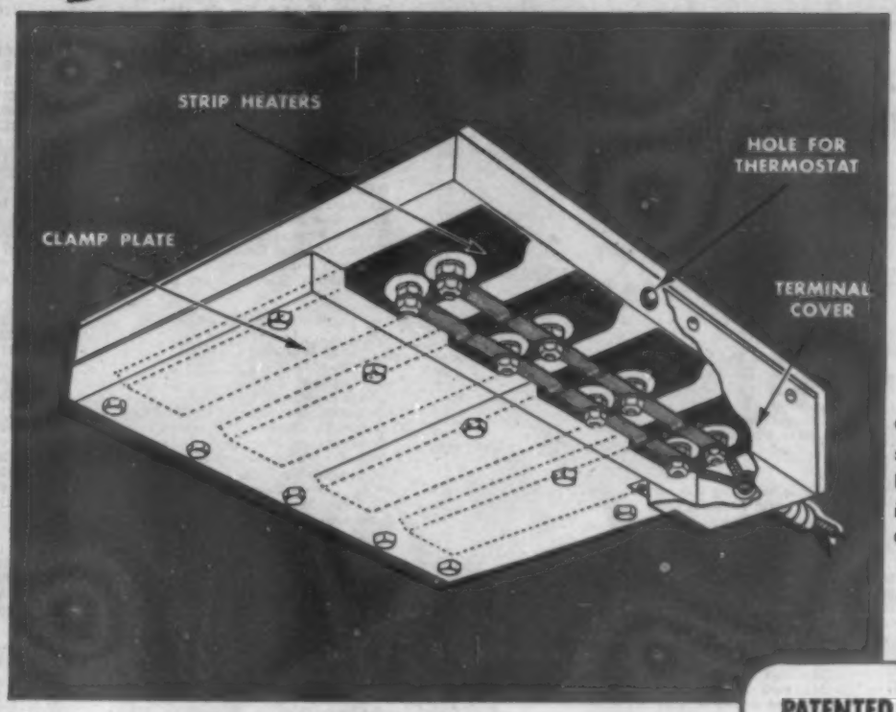

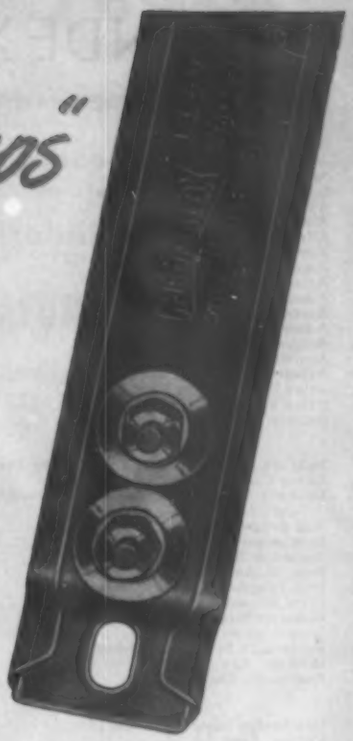

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CHROMALOX Strip Heaters are installed by welding stud bolts to tank bottom and clamping Strip Heaters in place with CHROMALOX Utility Clamps. (Illustrated left.)

For PRE-HEATING, MOLDING, CURING

You get quick heat—when and where you want it—with CHROMALOX Strip Heaters. They provide dependable, efficient, economical "around the clock" service in plastic applications requiring continuous, accurately-controlled temperatures.

Users of Heat find it "more than pays" to change to CHROMALOX Electric Heaters. In thousands of plastic applications—heating molding presses, platens, moving parts, process machinery, cleaning tanks, melting pots, etc.—CHROMALOX Heaters are proving themselves in performance, reliability and long service life.

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IC-15

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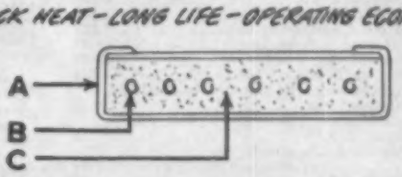
ASSURES

QUICK HEAT - LONG LIFE - OPERATING ECONOMY



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The heat source of CHROMALOX Electric Heaters is nickel-chromium wire embedded in a special refractory and encased in a metal sheath. Efficient heat transfer from heat source to sheath is assured by hydraulically compacting refractory surrounding resistance wire. The unit is fired to semi-vitrify and cure the refractory. Thus the refractory becomes an insulator around wire and serves as an efficient conductor to transmit heat to the sheath surface. All CHROMALOX Heaters are thoroughly tested during and after manufacture to meet rigid standards of performance.

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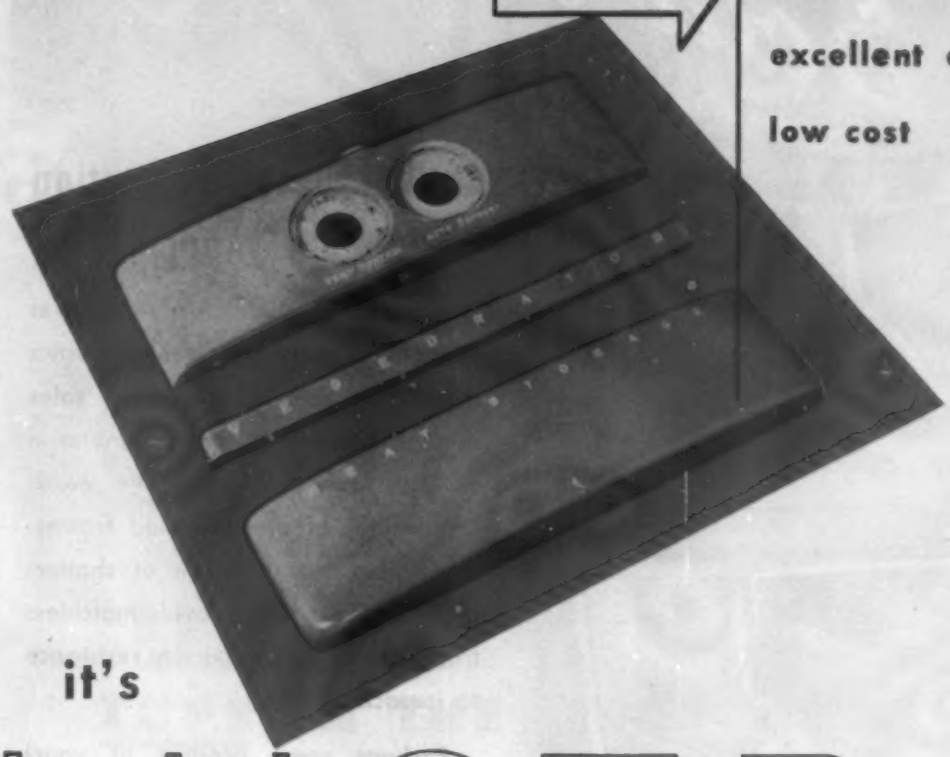
excellent electrical properties

low cost



it's

LUSTRON

While many plastics grow brittle as temperatures drop, Lustron... tough and stable to begin with... actually shows *increased* strength, chilled even to sub-zero temperatures.

Add this factor to Lustron's exceptional dimensional stability, its freedom from taste or odor, its resistance to food acids and cleansers, plus its sparkling decorative qualities and you can understand why virtually every leading domestic refrigerator maker is again using Lustron... for freezing unit doors, light shields, sealing frames, drip trays, drawer fronts, handles and trim.

This combination of reasons that influence refrigerator manufacturers may suggest new, better Lustron applications to you. Complete information and technical assistance in adapting Lustron, Monsanto's war improved polystyrene, to your needs are yours for the asking... write, wire or phone: MONSANTO CHEMICAL COMPANY, Plastics Division, Springfield 2, Massachusetts.

The broad and versatile family of Monsanto Plastics includes: Lustron® polystyrenes • Carex® heat resistant thermoplastics • Vinyl acetals Nitron® cellulose acetates • Thalid® for impression molding • Resinox® phenolics • Resimene® melamines • Forms in which they are supplied include: Sheets • Rods • Tubes • Molding Compounds • Industrial Resins • Coating Compounds Vuepak® rigid transparent packaging materials.
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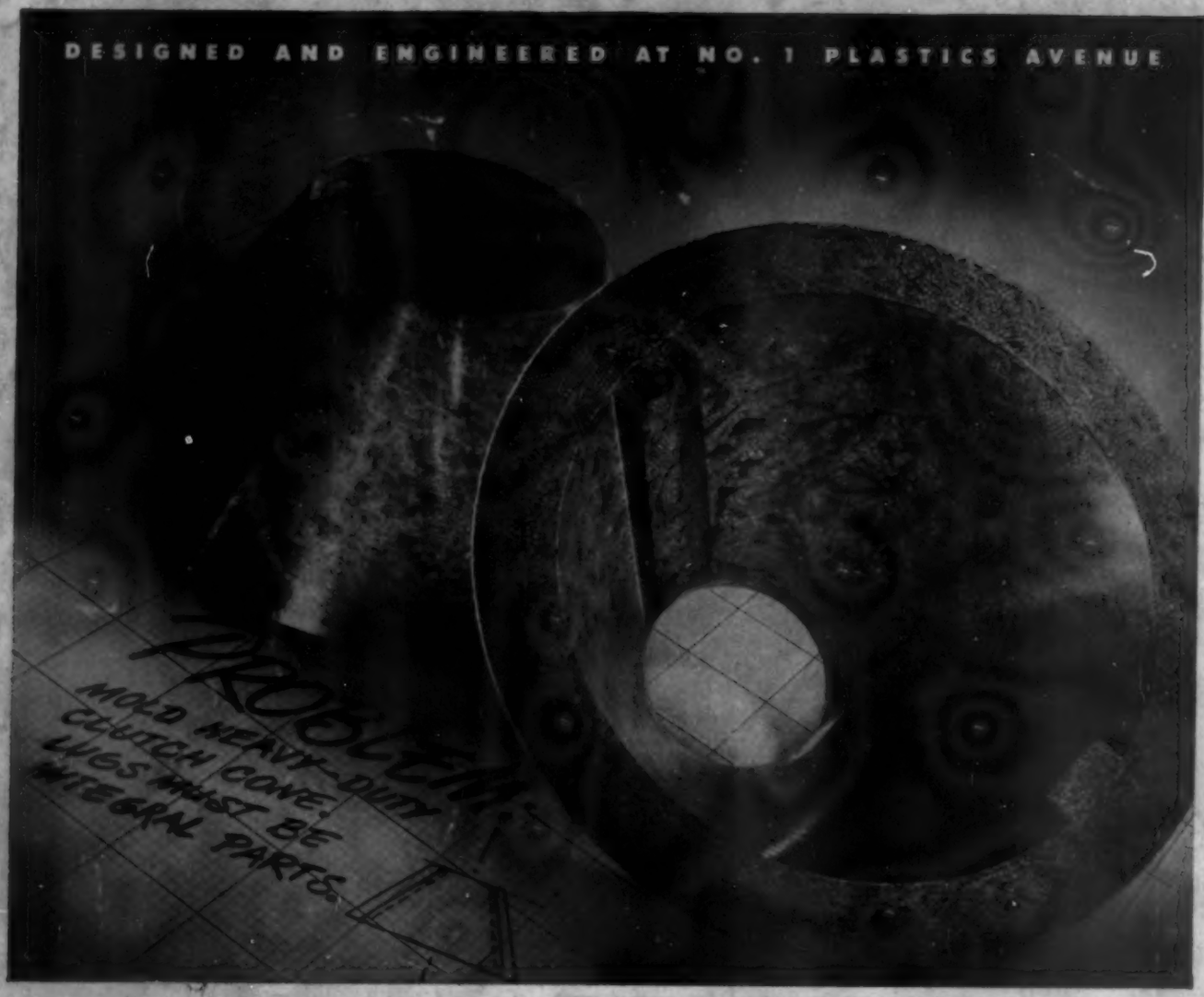

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